Hong Kong's Connected Future

Building a smarter and greener city

Survey conducted by

YouGov
What the world thinks

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Contents

Viewpoints

Foreword

The coming decades hold great promise for Hong Kong's continued development as a smart and sustainable city. The rollout of 5G connectivity across the territory combined with strengthened capabilities in artificial intelligence, big data, blockchain, cloud and edge computing will enable a new generation of digital-enabled urban applications. These hold the potential to bring a myriad of benefits for cities, such as reducing traffic congestion, creating more energy-efficient buildings, designing more liveable public spaces, and improving delivery of healthcare and other services.

The HKSAR Government's *Climate Action Plan 2050* announced in October 2021 presents an urgent imperative for government, businesses and citizens to work together to combat the global threat of climate change. The government's *Roadmap for the Popularisation of Electric Vehicles* released in 2021 further sets the stage for the phase out of fossil fuel cars and accelerated development of EV infrastructure. The construction of a next generation government cloud infrastructure and big data analytics platform, detailed in the city's *Smart City Blueprint 2.0*, brings the potential for heightened data sharing between departments and enhanced deployment of digital government services.

As technology-driven initiatives are rolled out, there is a need to ensure that solutions sufficiently meet the needs of Hong Kong's residents, and maximise collaboration between the public and private sector so that development is inclusive. The ongoing COVID-19 pandemic has demonstrated the ability for government and industry to collaborate effectively and work to reduce red tape and bureaucratic processes to fast track projects. Going forward, all parties must build on this spirit of cooperation to continue to drive citizen-centric initiatives that can have lasting benefits for communities. As more data is generated, coordination on cybersecurity initiatives is also increasingly critical to secure infrastructure and provide adequate data protections.

Hong Kong's Connected Future is the fourth annual study on Hong Kong's ongoing smart and sustainable city development produced by KPMG China in partnership with Autotoll, CGI, CLP, Cyberport, DLA Piper, JLL, Lenovo, MTR, Siemens, Signify, Sino Group, Smart City Consortium and theDesk. The study analyses Hong Kong's current smart and sustainable city planning and policy initiatives, providing citizen and business perspectives on the conditions and characteristics needed to create an optimal ecosystem. It also identifies opportunities for Hong Kong to develop best practice use cases for the Greater Bay Area, ASEAN and elsewhere in the region.

We hope you find this report insightful and welcome the opportunity to further discuss these findings.

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About the study

To capture the evolving views of Asia's urban residents on smart city development amid the ongoing COVID-19 pandemic, KPMG and its strategic partners commissioned YouGov to conduct a citizen survey of 4,096 residents in seven Asian markets, including Hong Kong SAR (1,038); mainland China cities within the Greater Bay Area (GBA) (506)*; Bangkok (500); Ho Chi Minh City (528); Kuala Lumpur (508); Singapore (514); and Shanghai (502); in May 2021.

In addition, to provide a well-informed view of the current challenges and opportunities for Hong Kong's smart transformation, KPMG drew insights from panel discussions involving a wide range of corporate, academic, start-up, public sector and NGO leaders at the 2021 Connected Cities Conference, held on 27 May 2021 as part of InvestHK's StartmeupHK 2021 Festival. KPMG also conducted additional in-depth interviews with over 20 senior executives from June to September 2021. The commentary takes into account smart city initiatives announced in Hong Kong Chief Executive Carrie Lam's 2021 Policy Address on 6 October 2021.

The nine mainland China GBA cities included in the study are Dongguan, Foshan, Guangzhou, Huizhou, Jiangmen, Shenzhen, Zhaoqing, Zhongshan and Zhuhai, all in Guangdong Province.

Executive summary

The *Hong Kong's Connected Future* report looks at the current opportunities and challenges for Hong Kong's ongoing smart city transformation, and the technology that can be harnessed to enable it. Based on a survey of 4,096 urban residents in Hong Kong, mainland China and other Asian markets as well as in-depth interviews and panel discussions with Hong Kong-based public and private sector executives, the study has identified the following trends:

The COVID-19 pandemic has positively affected attitudes towards digital transformation, tech adoption and data sharing

The pandemic has transformed the macro business environment and consumers' attitudes to technology. There has also been a significant increase in the take up of both government and private sector digital services among consumers, amid the implementation of anti-pandemic measures.

This increased adoption of digital services is likely to be a permanent shift, according to respondents polled. Seven out of 10 respondents (70 percent) say they are using digital payments and e-wallets more frequently, with 72 percent expecting this change to be permanent, while 70 percent of respondents are purchasing more goods and services online, a change that 65 percent expect to continue. Meanwhile, 67 percent of respondents have accessed public services and information online since the pandemic began. Again, two-thirds of these people (66 percent) expect these changes to be permanent.

The pandemic has also increased respondents' awareness of the benefits of technology in improving citizens' quality of life. More than three-quarters of those polled (78 percent) believe their city's anti-pandemic efforts will help their cities become smarter and more sustainable for the long-term, and 84 percent say the pandemic has increased their awareness of new technologies and applications that have improved their quality of life. More than 60 percent of people across all markets also say they would be prepared to share anonymised data to improve services, such as electronic health records and interactive transport apps.

Meanwhile, the pandemic has led to increased collaboration between the public and private sector, with industry players in Hong Kong reporting a reduction in red tape for entities working on government projects. Corporations have also shown an increased willingness to collaborate with start-ups on anti-pandemic efforts.

Placing community needs at the heart of Hong Kong's smart city vision will accelerate its development

The study suggests that Hong Kong can gain an edge over other jurisdictions through unique smart city positioning that closely aligns with the needs of residents and defines priority focus areas and sectors to achieve this alignment.

52 percent of respondents across the seven Asian markets surveyed say a safe living environment is the most important quality of a smart and sustainable city, followed by convenient public transport and manageable traffic at 47 percent.

In terms of societal needs, respondents in Hong Kong highlighted having access to affordable housing as the top concern with 53 percent citing it as a priority, while access to affordable quality healthcare was considered a key issue by 40 percent of respondents, followed by addressing poverty and inequality at 38 percent. These findings highlight the need to build more inclusive cities.

Hong Kong's property and transport sectors present significant opportunities to reduce the city's carbon footprint

Hong Kong's buildings and vehicles represent a significant proportion of the city's carbon emissions. Despite this, only 25 percent of respondents surveyed in Hong Kong think efforts to create carbon neutral buildings are sufficient, with just 19 percent of people thinking enough is being done to promote carbon neutral vehicles. Meanwhile, Hong Kong's efforts to repurpose underused buildings are considered to be sufficient by just 14 percent of survey respondents.

To meet the city's targets to become carbon neutral by 2050, existing buildings will need to be retrofitted to make them more energy efficient and reduce their carbon emissions, creating significant opportunities for businesses. Buildings also need to be used to generate electricity, such as through the installation of solar panels. In addition to retrofitting buildings, there is also a role for repurposing existing and obsolete buildings to give them new uses and enhance the communities in which they are situated.

The *Hong Kong Roadmap on Popularisation of Electric Vehicles* released by the government in March 2021 is expected to accelerate the city's shift towards clean energy cars. However, individual and private sector adoption of electric vehicles (EVs) will be crucial to meeting the city's goals, with EVs currently making up only 2 percent of privately-owned cars on the city's streets.

Data sharing and access to collaborative tools needed to optimise smart city innovation

As Hong Kong and other cities in the region continue to roll out new smart city applications powered by 5G connectivity, they will need to manage the vast new amounts of data being generated. This data needs to be properly structured, stored, shared and analysed to optimise the benefits for end users.

Open source platforms present great promise to facilitate large-scale data sharing between the public and private sector. As these platforms are being developed, a data sharing governance framework should be implemented to ensure that data assets are consistent.

New modes of collaboration between the public sector, private companies and citizens are also needed. In Hong Kong, survey respondents identified cooperation between government, private sector and citizens as the most important factor to ensure smart city solutions are impactful. This study points to 'sandboxes' – virtual environments for software developers to test new applications and gather data and feedback on them – as an important area for further development and expansion across multiple sectors.

Continuous improvement of data security governance is needed to safeguard Hong Kong's digital ecosystem

Data security is another area that requires attention. Although citizens polled showed an increased willingness to share their data, more than half of respondents in Hong Kong (55 percent) mentioned data security and privacy as a top-three factor to consider when cities implement new initiatives. It was also seen as a key consideration by those in mainland China GBA cities and other Asian cities.

These findings highlight the need for enhancement of Hong Kong's cybersecurity regulations, to protect both individuals' data and critical government infrastructure from cyberattacks. There is also a need for the city to develop a set of industry-wide security standards for Internet of Things (IoT) devices and projects.

Opportunities for Hong Kong to develop best practices for the rest of the GBA and ASEAN

As Hong Kong continues to develop smart city solutions, it is in a strong position to develop use cases that can be applied to other markets in the GBA and ASEAN. The city's status as a logistics hub and financial centre enables innovation in the areas of logistics and digital supply chain, and fintech, Regtech and sustainable finance, while its dense urban landscape offers opportunities for the development of proptech solutions.

Suggestions for policymakers and businesses on how to further improve Hong Kong's smart city ecosystem can be found at the conclusion of this report.

The COVID-19 pandemic has positively affected citizen attitudes towards digital transformation
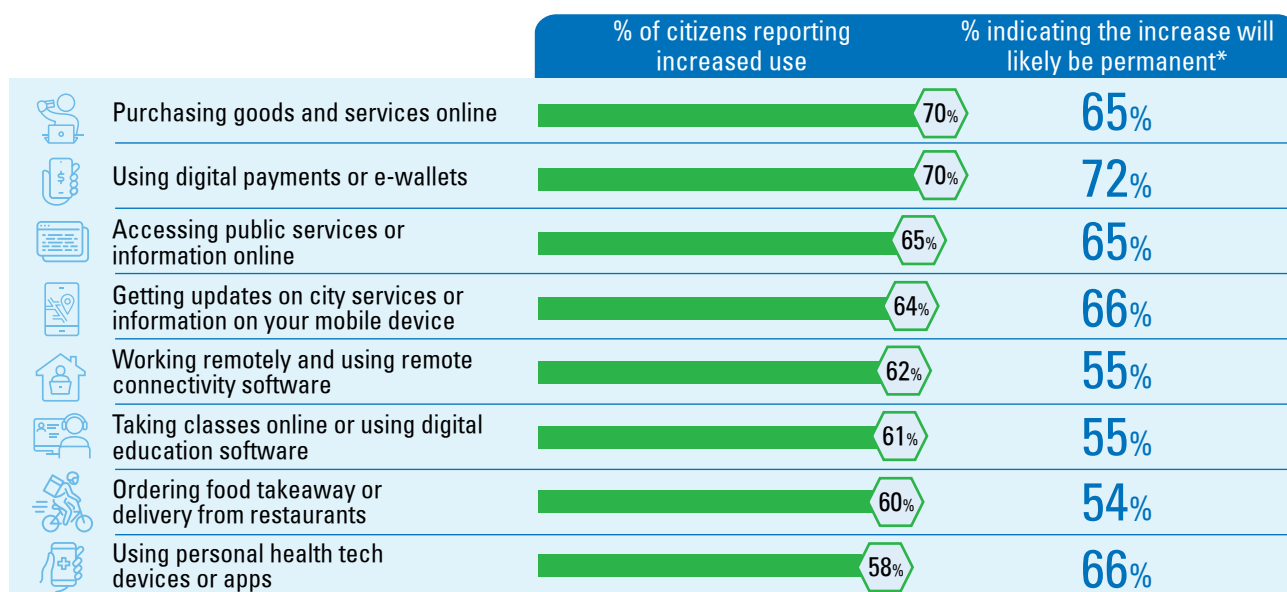
Our 2020 report on Hong Kong's ongoing smart city development identified the important role government has to play through driving innovation and fostering co-creation and cooperation between the public and private sectors.[1] It also highlighted the need for corporates and start-ups to partner with each other to develop and test solutions.

Since our last report, both the macro business environment and consumers' attitudes to technology have been transformed by the COVID-19 pandemic. In Hong Kong, amid the implementation of anti-pandemic controls and measures, our research finds there has been a significant increase in the take up of digital government services among residents.

Changing attitudes towards the adoption of digital services in the wake of the pandemic are reflected in our 2021 citizen survey, with respondents saying the pandemic has increased their use of various types of services, with a majority indicating that the shift will likely be permanent.

70 percent of respondents say they are using digital payments and e-wallets more frequently, with 72 percent expecting this change to be long-term [see Figure 1]. Meanwhile, 70 percent say they are purchasing more goods and services online, a change that 65 percent expect to continue in the long run.

Figure 1. Increased citizen use of digital services during the COVID-19 pandemic

	% of citizens reporting increased use	% indicating the increase will likely be permanent*
Purchasing goods and services online	70%	65%
Using digital payments or e-wallets	70%	72%
Accessing public services or information online	65%	65%
Getting updates on city services or information on your mobile device	64%	66%
Working remotely and using remote connectivity software	62%	55%
Taking classes online or using digital education software	61%	55%
Ordering food takeaway or delivery from restaurants	60%	54%
Using personal health tech devices or apps	58%	66%

Source: KPMG survey analysis of citizens in seven Asia-Pacific markets
*Among those who reported increased use

A majority of respondents (65 percent) also say they are more likely to access public services and information online since the pandemic began, while 64 percent of those polled say they are now more likely to obtain updates on city services and information through their mobile devices. Again, roughly two-thirds of these people expect these changes to be permanent.

In Hong Kong, this positive uptake in digital government services is reflected in the "iAM Smart" initiative, a government platform launched in December 2020 that gives residents a digital identity and enables them to access more than 150 public and private services online, such as tax payment, vehicle license renewal and student finance.[2] Residents receiving COVID-19 vaccinations at community vaccination centres were encouraged to register for the service. As of August 2021, the platform had more than 800,000 registered users.[3]

Meanwhile, eHealth, the HKSAR government's electronic health record sharing scheme, is currently being used by 4.1 million people.[4] The LeaveHomeSafe app, which helps facilitate identification and testing for those who have visited locations that have confirmed COVID-19 cases is now required to enter many premises, including government buildings, medical and sports facilities, restaurants and shops.

Distribution of the Consumption Vouchers Scheme, under which the government is giving HK$5,000 in spending vouchers to eligible residents to help stimulate the economy, is also being done through digital channels, with the vouchers downloaded on to stored value facilities, such as Octopus cards and AlipayHK.[5] The pandemic has also accelerated the rollout of HA Go, a Health Authority app[6] through which residents can make appointments at hospitals and clinics, pay bills, and view prescriptions and rehabilitation exercises. The launch of a TeleHealth pilot in 2021 through the HA Go app has also increased the number of patients who have access to virtual doctor appointments.[7]

Higher citizen willingness to share data, amid positive perception of the benefits of digital solutions

Survey respondents across the seven markets we polled also say the pandemic has raised their interest and awareness of how to improve life for urban residents. More than three-quarters (78 percent) believe that cities' anti-pandemic efforts will help their cities become smarter and more sustainable over the long-term [See Figure 2]. An even larger majority (84 percent) say the pandemic has increased their awareness of new technologies and applications that have improved their quality of life.

Figure 2. Impact of the COVID-19 pandemic on citizen views related to smart city development

% of citizens who agree

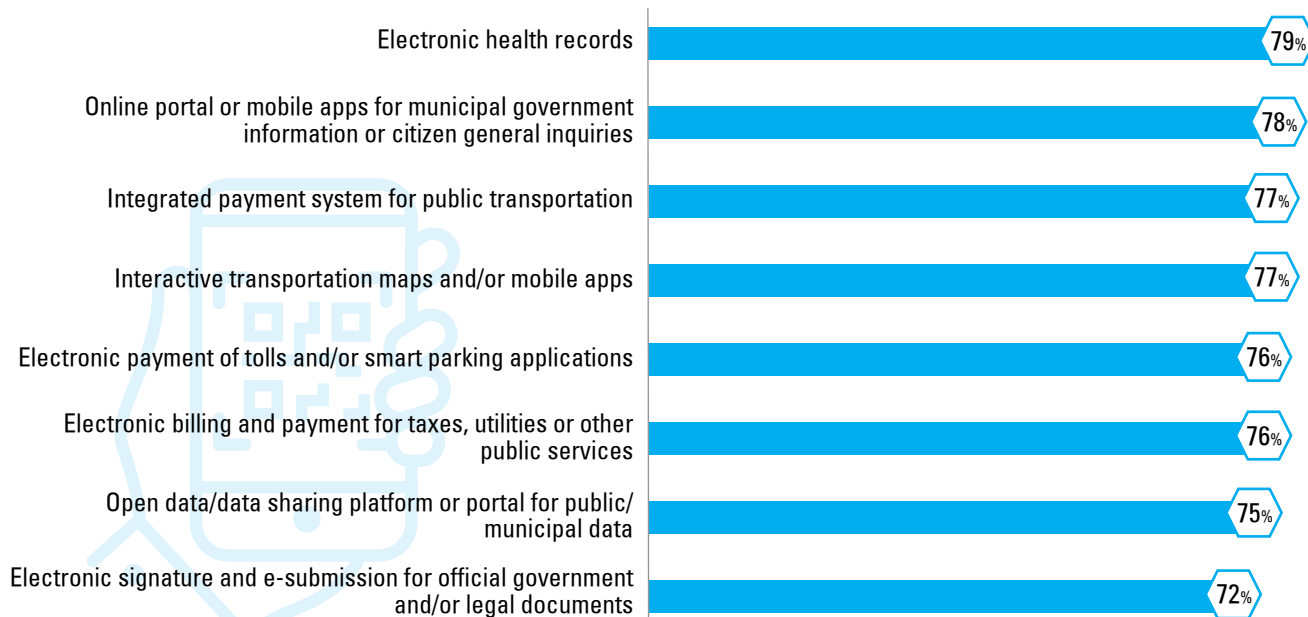|	
Increased citizen awareness of new technologies/apps that have meaningfully improved quality of life	**84**%
Increased citizen interest in sustainability initiatives	**78**%
Anti-pandemic efforts are helping cities become smarter and more sustainable for the long term	**78**%
Increased citizen interest in how cities can improve economic opportunity and empower communities	**77**%
Changed citizen views on what it means for cities to be "smart" and "sustainable"	**76**%

Source: KPMG survey analysis of citizens in seven Asia-Pacific markets

Rising awareness of the benefits of technology has also led to citizens being more amenable to share their data to improve services, provided that the data is anonymised before use. More than 70 percent of people across all markets say they are willing to share anonymised data on various types of apps and platforms [See Figure 3].

Figure 3. Citizen willingness to share data to improve digital government services

% willing to share their anonymised personal data to improve service*

Service	%
Electronic health records	79%
Online portal or mobile apps for municipal government information or citizen general inquiries	78%
Integrated payment system for public transportation	77%
Interactive transportation maps and/or mobile apps	77%
Electronic payment of tolls and/or smart parking applications	76%
Electronic billing and payment for taxes, utilities or other public services	76%
Open data/data sharing platform or portal for public/municipal data	75%
Electronic signature and e-submission for official government and/or legal documents	72%

*Among respondents who are aware of these services
Source: KPMG survey analysis of citizens in seven Asia-Pacific markets

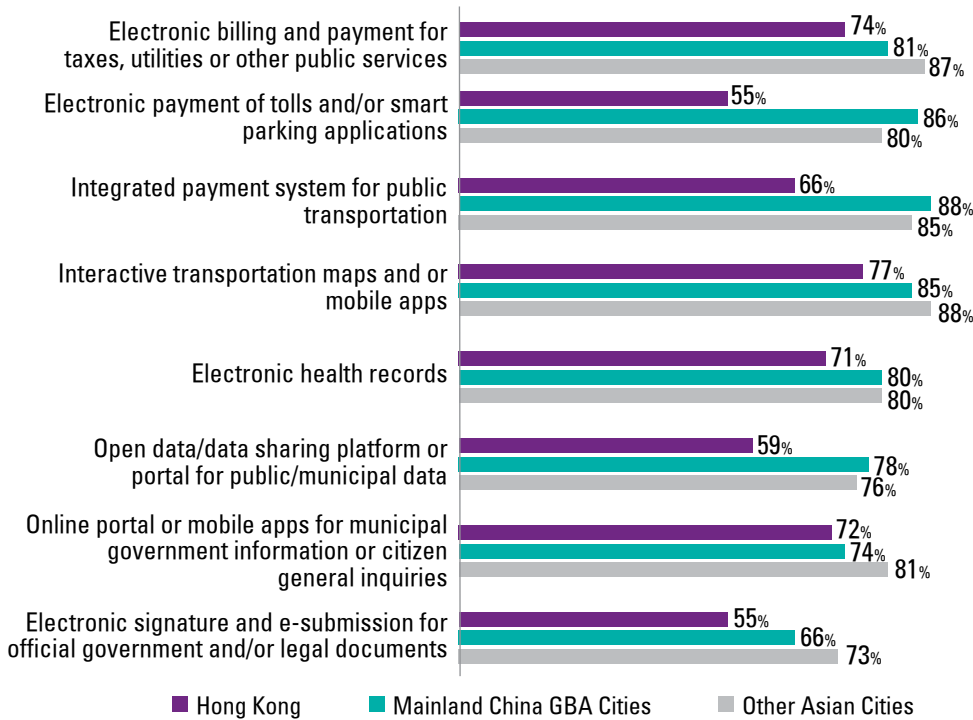### Rising awareness of digital government services linked to positive perception of benefits for citizens

The increased availability of government digital services has been welcomed by survey respondents. A majority of residents polled show readiness to use a variety of digital and e-government services, although there are varying degrees of readiness according to location and type of service [see Figure 4 on next page].

A comparison with our 2019 study points to a positive correlation between citizen awareness and readiness to use e-government services in Hong Kong. 82 percent of survey respondents are now aware of online portals and mobile apps for government information, up from 67 percent in 2019, with 72 percent showing readiness to use them. Following a similar trend, 85 percent of Hong Kong respondents are aware of interactive transport apps, compared with 80 percent in 2019, while 77 percent are ready to use them. This confirms our previous observation that increased awareness of digital services often leads to improved readiness to engage with these services, highlighting the benefits of communication about the benefits to citizens.

Figure 4. Readiness to engage with digital government services*

Electronic billing and payment for taxes, utilities or other public services
- Hong Kong: 74%
- Mainland China GBA Cities: 81%
- Other Asian Cities: 87%

Electronic payment of tolls and/or smart parking applications
- Hong Kong: 55%
- Mainland China GBA Cities: 86%
- Other Asian Cities: 80%

Integrated payment system for public transportation
- Hong Kong: 66%
- Mainland China GBA Cities: 88%
- Other Asian Cities: 85%

Interactive transportation maps and or mobile apps
- Hong Kong: 77%
- Mainland China GBA Cities: 85%
- Other Asian Cities: 88%

Electronic health records
- Hong Kong: 71%
- Mainland China GBA Cities: 80%
- Other Asian Cities: 80%

Open data/data sharing platform or portal for public/municipal data
- Hong Kong: 59%
- Mainland China GBA Cities: 78%
- Other Asian Cities: 76%

Online portal or mobile apps for municipal government information or citizen general inquiries
- Hong Kong: 72%
- Mainland China GBA Cities: 74%
- Other Asian Cities: 81%

Electronic signature and e-submission for official government and/or legal documents
- Hong Kong: 55%
- Mainland China GBA Cities: 66%
- Other Asian Cities: 73%

Legend: ■ Hong Kong ■ Mainland China GBA Cities ■ Other Asian Cities

Rising awareness equals higher readiness to use e-government services in Hong Kong

2021 vs 2019

Government portal websites
- Citizen awareness +15%
- Readiness +26%

Electronic bill payment for public services
- Citizen awareness +6%
- Readiness +18%

Interactive transport maps
- Citizen awareness +5%
- Readiness +11%

Among respondents who are aware of these services
Source: KPMG survey analysis of citizens in seven Asia-Pacific markets

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"The COVID-19 pandemic has shown that it is possible to cut through red tape or systemic operating principles to create solutions that can have an immediate impact."

Daniel Chun
Vice President,
Smart City Consortium

Public and private sector showing enhanced willingness to collaborate since onset of pandemic

Our research also suggests that the pandemic has led to increased collaboration between the public and private sector, as all parties have recognised the need to move quickly to find and implement solutions to the public health issues created by COVID-19.

An early such example was the creation of the Centre for Health Protection's COVID-19 Dashboard, a mobile-friendly website that uses open data and geographical information to show the details of daily COVID-19 cases, deaths and hospitalisations, as well as giving cumulative numbers and showing the locations visited by people who have tested positive in the past 28 days. The Dashboard was created through cooperation between the Office of the Government Chief Information Officer, the Health Authority and the Lands Department, as well as the private sector.

The government has also reached out to industry to help with anti-pandemic measures. The Electrical and Mechanical Services Department launched a thematic page on its E&M InnoPortal, publishing a 'wish list' of innovations and solutions needed by the government to tackle the pandemic. The initiative led to the trialling of solutions ranging from touchless lift button technology to antimicrobial coatings for door handles and disinfection robots.[8]

Daniel Chun, Vice President and Chair of the Research and Blueprint Committee, at Smart City Consortium, says the shared adversity of the pandemic has prompted more efficient collaboration between public and private organisations. He adds that there is a lot of local industry know-how in Hong Kong that was insufficiently tapped prior to the pandemic: "COVID-19 has really changed this mindset. The government has increasingly reached out to different industry associations and professional bodies to drive results."

Alongside the public sector, corporations have also shown an increased appetite for technology adoption and a higher degree of willingness to collaborate on projects. Eric Chan, Chief Public Mission Officer at Cyberport, explains: "The COVID-19 pandemic has increased awareness of the potential for digital technology and the need for digital transformation went from 'nice-to-have' to being an absolute necessity. Those who had not invested enough were suffering and they needed to go to suppliers and look for solutions so that they could continue to do business." He adds that while in the past education technology companies had faced issues getting access to schools to present their solutions, during the pandemic schools have been reaching out to them and asking them for help. "It has turned the tables," he says.

Alongside this boost in technology adoption has come an increased willingness to collaborate with start-ups to provide and co-develop solutions. Andrew Young, Associate Director, Innovation at Sino Group, elaborates: "We have seen a flourishing of the start-up community to provide technology solutions to tackle the pandemic. It has had a multiplying effect on the adoption of new technology." He gives the example of sanitising robots and robotic cleaners that are being used in many shopping malls and office buildings.

Another example is the Braving the Epidemic initiative launched by start-up incubator Cyberport in 2020. The project involved more than 70 Cyberport start-ups creating solutions to help society and businesses respond to the challenges brought about by the pandemic. One such project led by start-up VisionMatrix involved working with a construction site solutions technology firm to develop a facial recognition algorithm that can identify workers while they are wearing face masks.[9]

The pandemic has also seen start-ups turn their attention to solving problems created by social distancing. One example is Handy Rehab, which developed robots with high-definition cameras and video conferencing capabilities to enable families to stay in touch with elderly relatives in care homes when they were not allowed to visit due to social-distancing measures. The robots are also able to carry out simple health checks, such as monitoring patient's temperature, blood pressure and oxygen levels.[10]

Another innovator in this space is Hong Kong-based start-up Rice Robotics, which created robots that are able to navigate their way through buildings and use lifts. In addition to sanitising public spaces, the company's robots are being used to deliver food to people in quarantine hotels to reduce face-to-face contact with staff.[11]

The increased trend for office workers to work from home during the pandemic has also caused both employers and property managers to rethink how city space is used. Bowie Ma, Senior Manager - Innovation & New Products of co-working operator theDesk, argues that the rise in remote working has heightened the need for collaborative spaces in office buildings, since employees are now more likely to come into the office specifically for meetings as opposed to individual work. She says that co-working spaces can serve as a connector between building owners, businesses and people to transform ageing buildings in a city into meaningful and productive spaces [see page 14 for more information].

"We have seen a flourishing of the start-up community to provide technology solutions to tackle the pandemic. It has had a multiplying effect on the adoption of new technology."

Andrew Young
Associate Director, Innovation, Sino Group

Building on the momentum

While technology adoption has clearly received a boost from the conditions created by the pandemic, there is a need to maximise the lasting impact of this momentum going forward.

In subsequent chapters in this report, we further discuss challenges and opportunities for Hong Kong as it moves toward its goal to build a connected, digital-enabled smart city. We examine further areas where government, businesses and citizens can work together on Hong Kong's most pressing issues, including sustainability and climate change resilience, addressing the needs of citizens, and further opportunities to connect with cities across the region to solve urban problems. We also explore pressing considerations for the city as it further develops this digital-enabled ecosystem – including developing a comprehensive smart city strategy, cybersecurity and data privacy, and methods and platforms to effectively co-develop and test solutions.

" Originally, the vision of more connected and integrated infrastructure and city services, sharing data and intelligence pre-dated the technology needed to deliver it. What is really exciting is we are now seeing the technology catching up with that smart city vision. "

Dan Byles
Chief Commercial Officer,
UnifAI Technology

Mindset changes from pandemic can boost smart city development

Daniel Chun
Vice President, Smart City Consortium

The COVID-19 pandemic has significantly accelerated Hong Kong's smart city transformation due to the urgency it has created to develop and adopt technology solutions.

The pandemic has increased collaboration both across different government departments and between the government and industry, while it has also encouraged the take up of new technology among residents, according to Daniel Chun, Vice President and Chair of the Research and Blueprint Committee at Smart City Consortium (SCC).

He gives the example of the Centre for Health Protection's COVID-19 Dashboard, a mobile friendly website that was created through public-private cooperation. The site uses open data and geographical information to show the details of the daily and cumulative number of COVID-19 cases, deaths and hospitalisations, as well as the locations visited by people who have tested positive in the past 28 days.

"It uses open data sets from a number of different government departments, and involved collaboration between the Office of the Government Chief Information Officer, the Health Authority and the Lands Department, as well as the private sector. The site was available during the first month of the pandemic and was one of the earliest dashboards launched in Asia," he says.

In addition, the pandemic has increased the government's willingness to explore public-private partnerships to tackle various issues, as demonstrated by the COVID-19 thematic page launched by the Electrical and Mechanical Services Department on its E&M InnoPortal in February 2020. The page included a 'wish list' of anti-epidemic solutions, which led to over 200 proposals being submitted by technology firms in Hong Kong and the Greater Bay Area (GBA). These solutions range from self-disinfecting coatings to robotic technology for fever screening, many of which have been trialled by the government.

"The pandemic has shown that sometimes you have to cut through the red tape to get an immediate benefit. The government has really changed its mindset and has contacted different industry bodies, including SCC, to obtain industry know-how," he says.

Harnessing blockchain to verify health and financial data

Re-opening Hong Kong to international business travellers and enabling workers to resume travel across the mainland China border are critical to the city's post-pandemic recovery. In this respect, Chun says technology can play an important role.

SCC has proposed an 'eHealthPass' mobile phone app which would allow Hong Kong residents to receive and store their testing and vaccination certificates and share that information with third parties. Using blockchain technology, the app could verify that these documents were issued by trusted organisations. The app could also be linked to international platforms to enable people in Hong Kong to travel overseas, and those from other countries to enter Hong Kong.

Trade finance is another key area in which Chun thinks technology can be utilised to enhance Hong Kong's status as a trade and logistics hub. "The HKSAR government has talked about using blockchain technology to support data visibility and to reduce the cost of transactions, using new reverse factoring trade-finance solutions," he says.

The Hong Kong Monetary Authority's eTradeConnect platform, which is operated by Hong Kong Interbank Clearing Limited, uses distributed ledger technology to connect parties such as buyers, sellers and banks. However, Chun points out it has not yet been widely used by Hong Kong enterprises. "Most vendors still use their own means to finance their trade, rather than borrowing from banks using letters of credit."

Allowing eTradeConnect to operate by way of standardised API interfaces, he suggests, would allow individual banks to work directly with market participants. He points to a recent Singapore joint venture between Standard Chartered Bank and Linklogis as an example of the market potential for such types of blockchain-based trade-finance solutions that can address the factoring issues that trade finance economies like Hong Kong and Singapore are facing.

Accelerating the journey towards "City 4.0"

Erdal Elver
President and CEO, Hong Kong and Macao, Siemens

By adopting a "City 4.0" approach that optimises city operations, reduces carbon emissions and improves services to citizens, Hong Kong has the potential to become a world-class smart city within five to ten years, according to Erdal Elver, President and CEO, Hong Kong and Macao, for the technology company Siemens.

The "City 4.0" concept originates from Industry 4.0, which harnesses automation, Internet of Things (IoT), autonomous connecting of involved devices and big data to make the manufacturing process more efficient. In the context of a city, infrastructure, such as transportation systems, buildings and the energy grid, as well as the data they generate, are interconnected to each other and create valuable insights on which to base a strategic smart city roadmap.

"To successfully implement City 4.0, you need platforms which offer openness, scalability, security and useability that caters to different needs and smart city applications," Elver says. He adds that in Hong Kong, such a platform should also be interoperable to offer a seamless smart city experience and facilitate the scale-up of smart city innovations across Hong Kong and other Greater Bay Area (GBA) cities.

City 4.0 in action

One important idea of City 4.0 is 'Grid Edge' which enables efficient energy management and distribution. "By creating an interface between power demand and supply at the smart grid, such as through the Renewable Energy Feed-in Tariff scheme in Hong Kong, buildings with renewable power can sell energy to the grid when they are generating a surplus, as well as receive energy from it during times of peak usage," Elver says.

Such innovation, he explains, also applies to e-mobility by expanding energy storage and supply through vehicle-to-grid. "When connectivity is being substantially enhanced in City 4.0, multiple sources of power can be carefully managed to meet the ever-growing demand. That's why the adoption of platforms is becoming so important to handle the massive complexity in the energy system." The advancements in connectivity, technology and data analytics offered by City 4.0 allow infrastructure providers to monitor and run analytics on the energy use and generation, moving cities towards a more sustainable future.

Another area involves reducing traffic congestion in cities. In Taiwan, Siemens is currently using IoT sensors in vehicles and street furniture, such as traffic lights, to create intelligent traffic detectors. "In this way, we can optimise traffic flow by sending signals between vehicles and traffic lights, telling a car that the next traffic light will change in 20 seconds," he says. The sensors can also be used to change traffic lights to give priority to emergency vehicles.

Promoting the scalability of smart city solutions

To embrace digital transformation for scalability, Siemens has developed a range of platforms for different smart city applications. "MindSphere is an open cloud-based IoT operating system that links physical facilities in different locations and uploads the data they generate to the cloud. While it is currently being used for industrial applications, it can be also widely adopted for city infrastructure, by gathering data from buildings and using analytics to optimise energy efficiency or predict air quality," Elver says. "Using the artificial intelligence in MindSphere, our Connected City Solution collects and analyses environmental data in Hong Kong to predict climate and air pollution. There are also nearly unlimited opportunities to tackle other urban challenges, such as public safety and traffic congestion."

To facilitate collaborative work, Siemens has also acquired different tools and platforms to accelerate digital transformation for its customers. Mendix, a low-code software platform, empowers users to develop their own applications and intuitively participate through a web portal. Another technology, Enlighted, an IoT platform that consists of multi-function sensors, offers smart office solutions to identify and maximise occupancy rates within buildings and monitor social distancing requirements.

With the above mentioned technologies, Siemens not only offers technology solutions but can support Hong Kong to develop a strong city governance framework that brings subject matter people together to make thousands of decisions more efficiently.

Rethinking space: meeting workers' needs in the era of flexible working

Bowie Ma
Senior Manager - Innovation & New Products, theDesk

In the wake of the COVID-19 pandemic, flexible working has become the norm. While worker output has remained high as more employees work remotely, people still need physical spaces to meet and collaborate, says Bowie Ma, Senior Manager - Innovation & New Products of co-working space operator theDesk.

On one hand, CFOs have welcomed the shift to flexible working, as it has reduced the amount of office space their companies require. But in Hong Kong, where the average living space is just 170 sq. ft. per person and many people live in multigenerational households, working from home full-time can often be challenging. Further, some employees may find it isolating and miss the social interaction of the office, Ma says.

"The pandemic has demonstrated that people remain productive when they work from home, but the ability to collaborate is lost," she points out. "I think over the next few years we will see the importance of having alternative solutions which offer employees a flexible space to gather when they need to."

Building a community, not just a space

Aside from physical spaces where people can share ideas, building more "inclusive communities" within workspaces can also help to encourage collaboration and drive growth. theDesk encourages community building with landlords, tenants and suppliers in the buildings in which they operate to expand partnerships and create value for all members of the community.

"I think the more companies understand the community they are part of, the more it will drive the ability to grow and create new opportunities for people and change in the future," she says.

She gives the example of a partnership with Prohab, a medical and health group, under which Prohab offers its services out of theDesk's spaces on a revenue sharing basis. "It is a low-risk approach for them and for us it gets medical and well-being services into some of our locations. We are looking at more of these revenue sharing opportunities with different partners because it adds value to the whole building and makes it a community hub," Ma says.

The company also works in partnership with building owners, operating a site in the Kerry Hotel on a revenue sharing basis, while it has recently launched a new concept, theDesk2Go, with Link REIT, under which it offers quiet booths the size of a telephone kiosk in malls. People can rent the booths by the hour if they need somewhere quiet in which to work or have a conference call. It is also exploring collaboration with other real estate companies and developers to put the booths in additional shopping malls and the clubhouses of residential developments.

Giving old buildings new life

Ma thinks co-working is one of the most significant disruptions to the real estate market in recent years. But in order to be successful, she stresses that co-working providers need to offer more than just space.

"Co-working is not about space, it is about people, about community and collaboration. It is completely flipping the idea of space being the core product, to community being the core product. I don't see theDesk as a space provider, we are very much an enabler."

This mission includes helping cities like Hong Kong to transform older 'grade B' buildings, defined as those in less sought-after locations and with lower quality finishes than their 'grade A' counterparts. "Sustainability is not just about the green aspect, it is about how you can make these buildings more than they were before," she says. "It is about taking an existing space and adding value to the whole building, bringing in new services, and creating something that is modern and fresh."

Chapter 2

Placing community needs at the heart of Hong Kong's smart city vision

Since our 2020 report, the Hong Kong SAR government has published its *Hong Kong Smart City Blueprint 2.0*,[12] an update on its original Blueprint released in December 2017. The Blueprint 2.0 lists 130 initiatives to expand and enhance city services and management in the areas of smart mobility, smart living, smart environment, smart people, smart government and smart economy. Initiatives range from setting up a HK$1 billion Smart Traffic Fund to promote vehicle-related innovation and technology, to piloting a rodent control scheme using IoT sensors, to developing a government-wide IoT network.

While there has been a steady increase in smart city initiatives, interviewees for this study point out that Hong Kong still needs a more comprehensive and coordinated smart city strategy in order to optimise the ecosystem, with well-defined key milestones and timelines for how it will achieve its goals.

David York, Vice President Hong Kong Operations at CGI Hong Kong, says: "Hong Kong's *Smart City Blueprint 2.0* sets out a vision of what a smart city could be, but I think we still need a more comprehensive strategy about how to drive policy and connect government departments. We need to encourage cross-industry collaboration through incentives and a strategic policy from the government that encourages businesses to work together, otherwise we will have silos of prototypes and miss opportunities to create territory-wide solutions."
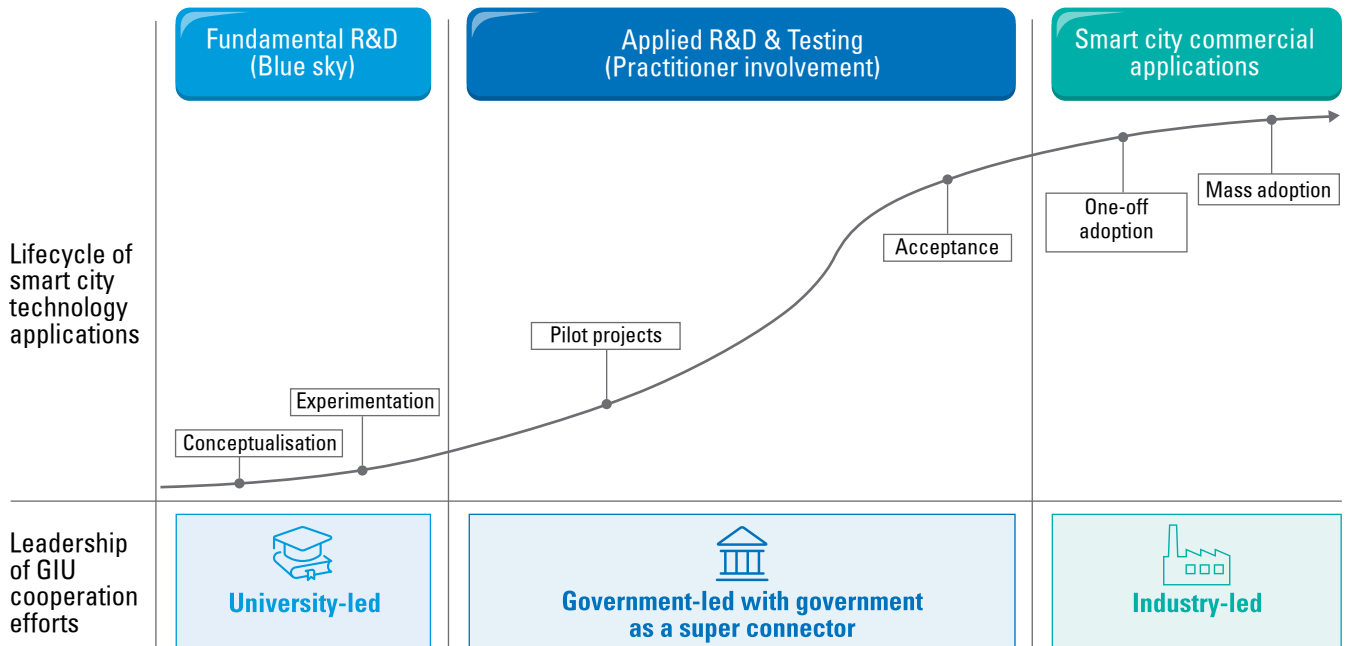
Erdal Elver, CEO of Siemens Hong Kong and Macao, agrees that smart city projects in Hong Kong need a more proactive approach to enhance the connectivity between the public and private sector. "Hong Kong's *Smart City Blueprint* is very comprehensive for each pillar of development, but more important is the need to transform a series of siloed actions into more collaborative and systemic strategies. Even if we have a great traffic system, it still needs to talk efficiently to the buildings or energy systems, reforming the city as a whole," he explains. He suggests the city should focus on how to have a crossover of ideas across different pillars of development, as opposed to taking a domain-specific or bureaucratic-specific approach to smart city development. Daniel Chun of Smart City Consortium adds that a lot of departments have started initiatives, but they are reporting them through their own websites, leading to reporting gaps and a lack of coordination.

It is also important to connect different elements of the city's infrastructure. This can be done through creating a platform-based ecosystem that allows these elements to better talk to each other and provide more advanced services to citizens, Elver of Siemens says. [For more information, see page 13].

Enhanced government-industry-university (GIU) collaboration to accelerate the development of commercial applications of smart city technologies

In the years ahead, continuing to successfully apply new smart city technology applications in Hong Kong will require ongoing collaboration between government, industry and universities (GIU) across the development lifecycle, from conceptualisation to acceptance and mass adoption (see Figure 5).

Figure 5. Government-Industry-University (GIU) collaboration throughout the smart city technology lifecycle

Fundamental R&D (Blue sky)	Applied R&D & Testing (Practitioner involvement)	Smart city commercial applications

Lifecycle of smart city technology applications

Mass adoption

One-off adoption

Acceptance

Pilot projects

Experimentation

Conceptualisation

Leadership of GIU cooperation efforts

University-led	Government-led with government as a super connector	Industry-led

Source: KPMG China Smart Cities Group

> **"Continuous engagement and collaboration between government, industry and universities will deliver significant value in Hong Kong's smart city evolution. This includes several benefits – such as easier identification of new technologies, services and ways of working that could be adapted from other global markets; reduced delivery risks for major projects; and enhanced socio-economic benefits to the community by tapping into private sector innovation."**

Michael Camerlengo
Head of Smart Cities and Infrastructure
KPMG China

Hong Kong's strong university academic research capabilities across smart city-related sectors such as infrastructure, urban planning, construction and engineering provide an ideal environment in the initial fundamental R&D, or "blue sky"stage. At the other end of the smart city technology lifecycle, the city benefits from its positioning as a global business hub – with many successful local and global companies headquartered in Hong Kong that are well-resourced to invest in these technology applications and apply them to their businesses.

"In this stage, there is an opportunity to accelerate the development of new smart city applications – for domestic use and export – through greater levels of GIU cooperation," Michael Camerlengo, Head of Smart Cities and Infrastructure, KPMG China points out. "Each of these groups has an important role to play – universities in catalysing forward-thinking ideas and fundamental R&D; industry providing clear direction regarding future business demand drivers and investing in applied R&D; and government performing the role of a super-connector between these groups and committing resources and support to initiatives that have the potential to deliver wider social, economic and environmental benefits to the community."

As GIU cooperation is strengthened, it will allow Hong Kong to evolve into a homegrown market for smart city technology applications, continuing to build the city's reputation as an innovation hub, create new business sub-sectors and enhance its capability to export solutions to other markets.

The GIU model has previously been applied in Hong Kong in the built environment through the establishment of the University-Government-Industry Consortium for Sustainable Urban Development in 2016, which consisted of 43 founding members including 10 Hong Kong government departments, eight local university institutes and 25 established property, engineering, construction, energy and technology firms.[13] "The Consortium showed that key players across government, industry and academia could work together on a broad scale to share knowledge and ideas – setting a good precedent for cooperation in other sectors related to smart city development," Camerlengo says.
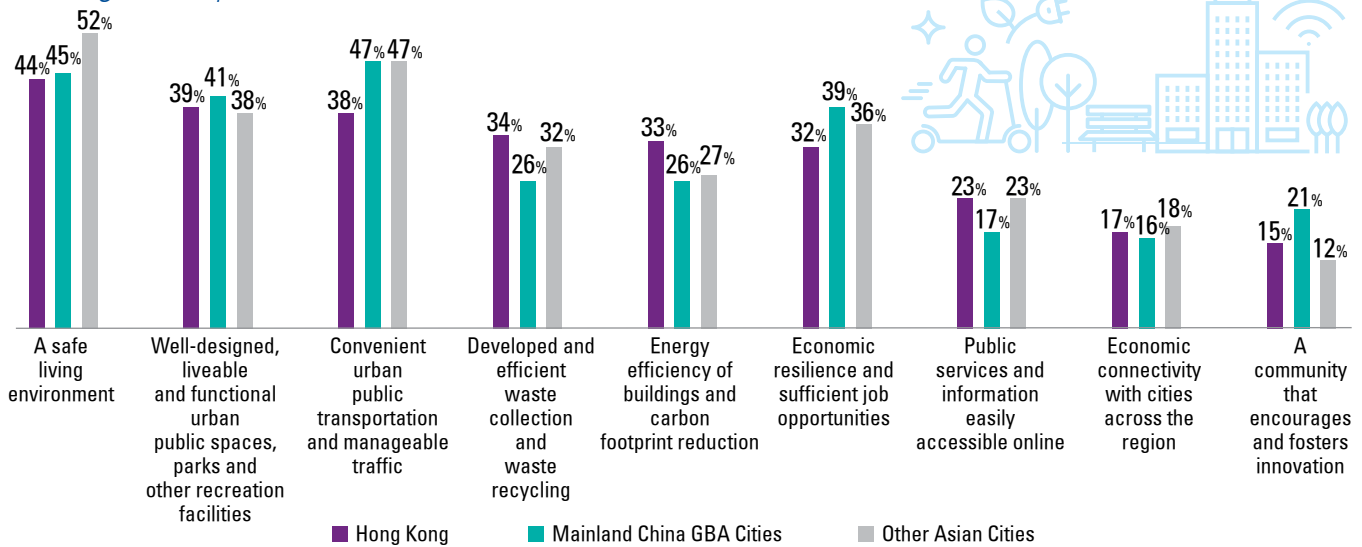
Aligning solutions with the needs of residents

Our survey findings reinforce the need to have comprehensive, coordinated city strategies that address societal needs.

Having a city that is easy to live in and move around in remains a priority for citizens, while the COVID-19 pandemic has also increased the emphasis on having a safe environment. Roughly half (50 percent) of overall survey respondents say a safe living environment is the most important quality of a smart and sustainable city, followed by convenient public transport and manageable traffic at 46 percent [Figure 6]. Well-designed, liveable and functional urban public spaces were seen as the third most important factor, cited by 38 percent of those polled.

Figure 6. Most important qualities of a smart and sustainable city

Among citizens polled

Quality	Hong Kong	Mainland China GBA Cities	Other Asian Cities
A safe living environment	44%	45%	52%
Well-designed, liveable and functional urban public spaces, parks and other recreation facilities	39%	41%	38%
Convenient urban public transportation and manageable traffic	38%	47%	47%
Developed and efficient waste collection and waste recycling	34%	26%	32%
Energy efficiency of buildings and carbon footprint reduction	33%	26%	27%
Economic resilience and sufficient job opportunities	32%	39%	36%
Public services and information easily accessible online	23%	17%	23%
Economic connectivity with cities across the region	17%	16%	18%
A community that encourages and fosters innovation	15%	21%	12%

Source: KPMG survey analysis of citizens in seven Asia-Pacific markets
Note: Respondents could select up to three answers

When asked about the most pressing challenges currently facing their own city, traffic congestion, environmental quality and healthcare were seen as key issues by citizens in the cities we polled [Figure 7]. In Hong Kong, unemployment and underemployment was considered to be the leading challenge, cited by 51 percent of survey respondents. Meanwhile, in Mainland China GBA cities, repurposing ageing or decaying buildings was seen as a more pressing challenge than in other markets.

Figure 7. Most pressing challenges facing your city
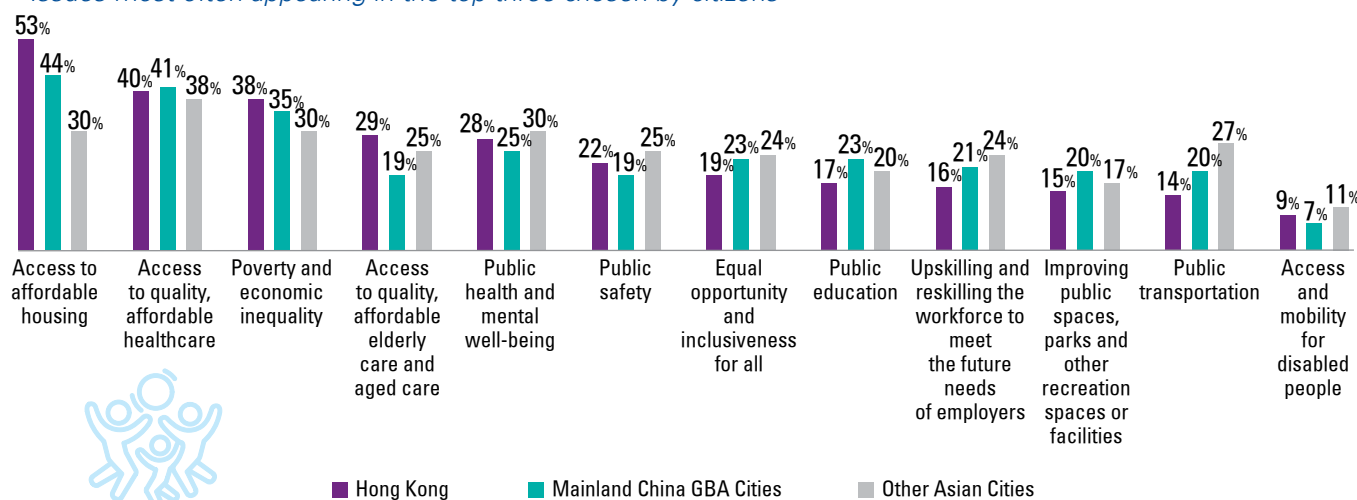
Among citizens polled
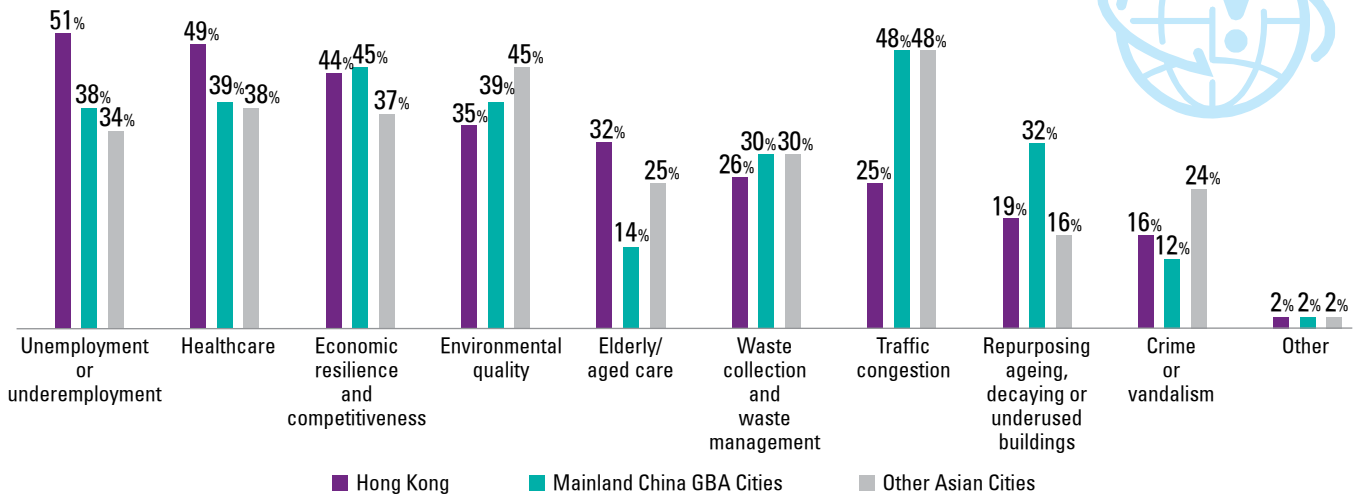
Legend: Hong Kong · Mainland China GBA Cities · Other Asian Cities

Categories and values:
- Unemployment or underemployment: 51%, 38%, 34%
- Healthcare: 49%, 39%, 38%
- Economic resilience and competitiveness: 44%, 45%, 37%
- Environmental quality: 35%, 39%, 45%
- Elderly/aged care: 32%, 14%, 25%
- Waste collection and waste management: 26%, 30%, 30%
- Traffic congestion: 25%, 48%, 48%
- Repurposing ageing, decaying or underused buildings: 19%, 32%, 16%
- Crime or vandalism: 16%, 12%, 24%
- Other: 2%, 2%, 2%

Top issues by market

Hong Kong	Mainland China GBA	Shanghai	Singapore	Kuala Lumpur	Bangkok	Ho Chi Minh City
1 Unemployment/ underemployment	1 Traffic congestion	1 Traffic congestion	1 Elderly/aged care	1 Traffic congestion	1 Economic resilience	1 Environmental quality
2 Healthcare	2 Economic resilience	2 Healthcare	2 Healthcare	2 Crime/vandalism	2 Environmental quality	2 Traffic congestion
3 Economic resilience	3 Healthcare	3 Environmental quality	3 Economic resilience	3 Environmental quality	3 Traffic congestion	3 Waste collection/waste management
4 Environmental quality	4 Environmental quality	4 Elderly/aged care	4 Unemployment/ underemployment	4 Unemployment/ underemployment	4 Healthcare	4 Unemployment/ underemployment

Source: KPMG survey analysis of citizens in seven Asia-Pacific markets
Note: Respondents could select up to three answers

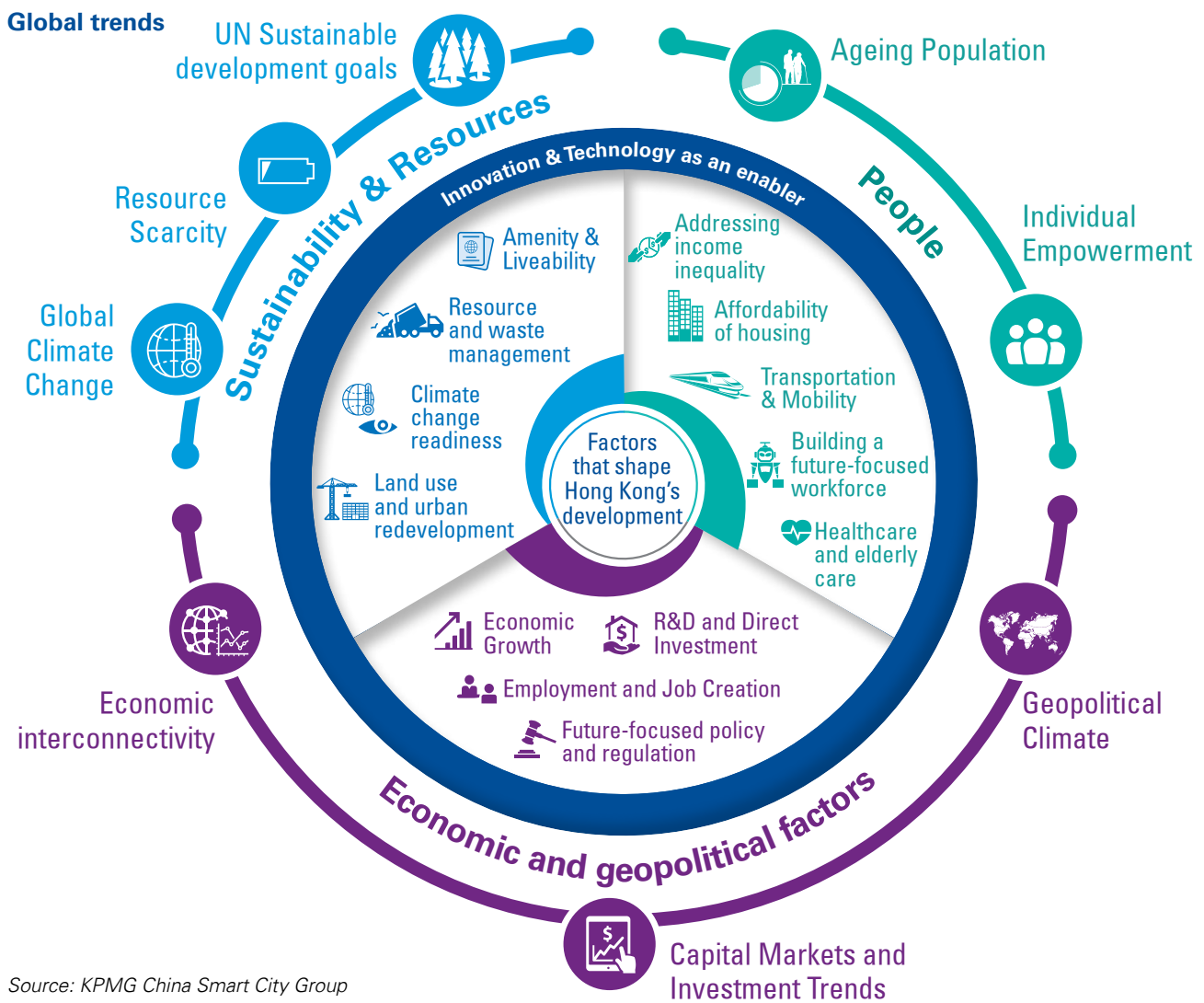Meanwhile, as Hong Kong continues its smart city development, it must continue to better understand and address community needs. In our survey, having access to affordable housing was cited as the top concern by respondents in Hong Kong with 53 percent citing it as a priority [Figure 8]. Access to affordable quality healthcare was considered a key issue by 40 percent of respondents, followed by addressing poverty and inequality at 38 percent.

Figure 8. Most urgent societal needs to be addressed in the next five to 10 years

Issues most often appearing in the top three chosen by citizens

Issue	Hong Kong	Mainland China GBA Cities	Other Asian Cities
Access to affordable housing	53%	44%	30%
Access to quality, affordable healthcare	40%	41%	38%
Poverty and economic inequality	38%	35%	30%
Access to quality, affordable elderly care and aged care	29%	19%	25%
Public health and mental well-being	28%	25%	30%
Public safety	22%	19%	25%
Equal opportunity and inclusiveness for all	19%	23%	24%
Public education	17%	23%	20%
Upskilling and reskilling the workforce to meet the future needs of employers	16%	21%	24%
Improving public spaces, parks and other recreation spaces or facilities	15%	20%	17%
Public transportation	14%	20%	27%
Access and mobility for disabled people	9%	7%	11%

Top issues by market

Hong Kong	Mainland China GBA	Shanghai	Singapore	Kuala Lumpur	Bangkok	Ho Chi Minh City
1 Affordable Housing	1 Affordable Housing	1 Healthcare	1 Healthcare	1 Public safety	1 Poverty/economic inequality	1 Public transportation
2 Healthcare	2 Healthcare	2 Affordable Housing	2 Elderly care/ aged care	2 Poverty/economic inequality	2 Healthcare	2 Healthcare
3 Poverty/economic inequality	3 Poverty/economic inequality	3 Poverty/economic inequality	3 Affordable housing	3 Public health/ mental well-being	3 Public transportation	3 Public safety
4 Elderly care/aged care	4 Public health/ mental well being	4 Elderly care/aged care	4 Upskilling and reskilling workers	4 Healthcare	4 Equal opportunity/ inclusiveness	4 Public health/ mental well-being

Source: KPMG survey analysis of citizens in seven Asia-Pacific markets
Note: Respondents could select up to five answers

Healthcare was also a top issue overall across all seven markets, cited by 39 percent of respondents, likely reflecting the impact of the pandemic. Addressing poverty and income inequality (32 percent) and public health and mental well-being (29 percent) also made it into the top five issues across the markets surveyed. This reinforces that a comprehensive smart city strategy should sufficiently address pressing social concerns, in addition to making the city run more efficiently.

Ensuring citizen-centric development

Since KPMG's inaugural study on Hong Kong's smart development in 2018, we have emphasised that a smart city needs to serve its citizens and make their lives better. In our 2020 report, we identified three key development areas that Hong Kong should focus on to address the challenges it will face in the coming decade, namely liveability and sustainability, economic connectivity and innovation, and addressing societal needs.[14] [Figure 9 on next page].

These three focus areas respond to global trends, such as climate change, resource scarcity, economic interconnectivity, technology disruption and ageing populations. They also pertain to internal factors, including land use and urban redevelopment, resource and waste management, income inequality and equipping the workforce with the skills needed for the future.

Figure 9. Factors shaping Hong Kong's ongoing development as a smart, sustainable, and connected city

Global trends

UN Sustainable development goals

Ageing Population

Resource Scarcity

Individual Empowerment

Global Climate Change

Economic interconnectivity

Geopolitical Climate

Capital Markets and Investment Trends

Sustainability & Resources
- Amenity & Liveability
- Resource and waste management
- Climate change readiness
- Land use and urban redevelopment

Innovation & Technology as an enabler

People
- Addressing income inequality
- Affordability of housing
- Transportation & Mobility
- Building a future-focused workforce
- Healthcare and elderly care

Factors that shape Hong Kong's development

Economic and geopolitical factors
- Economic Growth
- R&D and Direct Investment
- Employment and Job Creation
- Future-focused policy and regulation

Source: KPMG China Smart City Group

As Hong Kong moves forward with a wide range of new digitalisation initiatives, it is important that both government and industry ensure certain sectors of the population do not get left behind.

One issue which has caught public attention recently is accessibility of services for the elderly residents who may not regularly use smartphones. In September 2020, there were reports of delays in the rollout of the Consumption Voucher Scheme for some elderly residents who had opted for paper registration. This prompted lawmakers to call for more manpower to help facilitate registrations.[15]

In some cases, private companies have stepped in to help increase access to digital platforms that benefit residents. For example, when schools were closed as part of social distancing measures during the pandemic, some disadvantaged children in Hong Kong who did not have broadband access had difficulty accessing online learning. To help alleviate the issue, broadband provider Hong Kong Broadband Network waived broadband charges for 10,000 disadvantaged households for two years.[16]

KPMG's research also suggests there is a need to train citizens to use digital technology. Such training is important not only to ensure people can access digital services, but also to make sure Hong Kong has the talent needed to drive its economy forward. A majority of Hong Kong-based executives, entrepreneurs and students polled in KPMG's *Transforming Hong Kong*

Through Entrepreneurship 2020 study pointed out that more hands-on training is needed in technical fields to ensure Hong Kong has a future-ready talent pool.[17] Technology education is also an important part of ensuring citizen buy-in for digital-enabled city services. Elver of Siemens says: "Proper communication and education are critical to ensure that new technology solutions can be accepted by the public."

The Hong Kong SAR government has a number of initiatives in this area, such as its IT Innovation Lab in Secondary Schools programme, under which it provides enhanced IT training to students, as well as a training programme for civil servants.[18] However, there is also a role for the private sector and individuals themselves. "We all have to constantly upskill and reskill ourselves. Technology increases that pace because if you don't adapt and evolve with it, you get left behind as your skills become redundant," says Cunliffe of theDesk.

Formal steps to make cities more inclusive can be a starting point to help them be more responsive to the needs of residents. The World Bank's *Making the Cities of Tomorrow More Inclusive* report stresses the importance of ensuring the cities of the future provide opportunities for all citizens.[19] The paper promotes "spatial inclusion" by ensuring basic needs such as adequate food, water and housing are met; "social inclusion" through better citizen participation, and "economic inclusion" through access to employment opportunities. These concepts are also prominently featured in the United Nations Sustainable Development Goals.

Internationally, city governments are implementing a number of models to promote social inclusion. One example is Helsinki, Finland, which developed a "Participation and Interaction Model" to make the city more citizen-centric. The plan included digital tools to engage citizens to co-create better city services, with an Open Software Development Team at the core of the city's digitalisation efforts. It also provided inclusiveness training to better understand different methods and means of citizen participation for 38,000 city employees, and a participatory budget process where citizens could have a direct say on how to allocate public funds.[20]

In mainland China, citizen-centric concepts have been applied in the development plans for the Xiong'An New Area in Hebei Province, which addresses the social issue of inequality between urban and rural residents due to China's legacy hukou system. The Hebei provincial government's long-term plan for Xiong'An (2018-2035) established Xiong'An as a pilot area for innovative land and home purchase systems. The plan revisits land finance practices to make residents "co-stakeholders" in the city together with the government, aiming to suppress spikes in housing prices caused by real estate speculation. Meanwhile, migrants to the city can be granted permission to buy property in the city based on a point system that evaluates their social contributions as well as commitment to a green lifestyle.[21] The city has also established a goal of using 100 percent clean energy sources by 2035, and has served as a test area for self-driving vehicles.[22]

> **A central tenet of a smart city must be to create an inclusive society where all citizens have access to essential infrastructure and city services as well as opportunities for personal advancement through high quality education and employment. Cities can consider establishing a "Diversity, Equity and Inclusion" department or task force to bring a sharp focus on how to meet this challenge, with priority given to improving the lives of the most disadvantaged members of society.**
>
> **Julian Vella**
> Global Infrastructure Advisory, KPMG China

Public-private alignment on funding models, tech integration key to drive smart city transformation

David York
Vice President Hong Kong Operations, CGI

Steve Evans
Vice President Emerging Technologies, CGI

To accelerate its transformation into a 'smart' and 'sustainable' city, Hong Kong needs a clear, comprehensive strategy with tangible solutions setting out how it will achieve its vision.

The city already has many different smart initiatives and ecosystems, but without an overarching strategy and incentives to encourage collaboration, it will end up with disparate ideas and solutions that are not interoperable, according to David York, Vice President Hong Kong Operations at global technology services and solutions provider CGI.

He says the two main barriers Hong Kong faces in its smart city transformation are a lack of collaboration between different government departments and businesses, and a lack of integration and alignment of the many different initiatives and solutions.

"The key to overcoming these challenges is to have a clear vision and strategy across government and industry of what a 'smart city' is, as well as having funding for the key technologies and initiatives to encourage businesses to work together. Otherwise, we will have silos of prototypes and we will miss opportunities to create citywide solutions," York says.

He points out that many of the foundation technologies that are needed to create a smart city, such as artificial intelligence, machine learning, advanced analytics, robotics and 5G are already available and deployed in Hong Kong, albeit on a small scale.

"What will have the biggest impact is not the technologies themselves, but how we integrate the disparate solutions to collect and analyse the vast amount of data generated and convert it into public and business services, such as dynamic traffic management solutions, smart energy services and the provision of real-time citizen information to create truly connected communities," he says.

A social return on investment

Steve Evans, Vice President Emerging Technologies at CGI, adds that the business case for smart city projects not only needs to be connected to the overall vision for the city, but should also highlight the social and environmental benefits the solution would bring, alongside the economic ones.

"You have to make sure there is a tangible social benefit, whether it is about air quality, reduced energy usage or quality of life, such as better health. When looking at the return on investment, you have to go beyond economic elements and place a value on non-economic ones as well," Evans says.

One example Hong Kong can consider would be expanding its telehealth initiatives, a system that is used extensively in Singapore, to help residents stay in their homes as opposed to occupying hospital beds. "The drive to keep people in their homes and living well has both social and economic benefits. You save money on healthcare costs by not having them in hospitals and they have social and mental health benefits from being in their communities."

Evans explains that the way to achieve this outcome is through understanding how hospitals connect with the local community. At a basic level, this could involve medical staff interacting with the patient in their home through video calls to make sure they are taking their medication. The initiative could be combined with predictive analytics on healthcare data for a particular population or area to help identify public health trends that could inform government policy on health interventions to help prevent people developing chronic diseases that require hospitalisation.

York adds: "When we talk to health providers in Hong Kong, they use technology extensively within the confines of the hospital, such as electronic patient records management and remote AI-assisted diagnostics, but they have not extended that ecosystem to include integration with the family, community care providers and general practitioners to create an end-to-end connected healthcare service."

In terms of funding, it is also beneficial to have the public and private sector working together. Evans points out that public sector investment typically focuses on infrastructure and citizens, while private sector projects typically focus on using and integrating data and driving value through solutions. "The most innovative funding models are those that combine public and private investment in a targeted way."

Hong Kong's property and transport sectors present significant opportunities to reduce the city's carbon footprint

> *Jurisdictions across Asia and throughout the world are setting ambitious climate action goals. Within this paradigm, the shift from PPP to a "PPPP" (public-private-people partnership) model is more important than ever to help cities achieve net-zero targets in coming decades.*

Cynthia Chow
Associate Director,
Smart Cities,
KPMG China

Given the urgent imperative to address climate change, environmental sustainability has become an essential component of any smart city. As cities set carbon reduction and 'net-zero' targets, there is an urgent need to reverse the impact of their most carbon-intense sectors.

Hong Kong's Smart City Blueprint 2.0 mentions sustainable buildings, in particular, as a key area for the city to work towards net-zero targets. At present, buildings account for 90 percent of the city's energy consumption, representing 60 percent of the city's carbon emissions, according to Hong Kong 2050 Is Now, a climate action working group.[23] Meanwhile, around 20 percent of carbon emissions come from transport,[24] making the transport sector another key target for carbon reduction. These two areas – buildings and vehicles – represent significant opportunity areas for Hong Kong.

In 2020, Hong Kong SAR Chief Executive Carrie Lam set forth the city's goal to achieve carbon neutrality by 2050.[25] In her 2021 Policy Address, Lam said the government would set aside HK$240 billion to fund climate change mitigation and adaption measures.[26]

In October, the government published its *Climate Action Plan 2050*, setting out measures for how the city's net-zero goals will be achieved.[27] Stated measures include eliminating the use of coal for electricity generation by 2035, increasing the use of natural gas and renewable energy, developing green transport and improving the energy efficiency of buildings. The Environment Bureau will set up a new Office of Climate Change and Carbon Neutrality to oversee the implementation of measures set out in the report and strengthen coordination. A dedicated advisory committee will also be created to offer advice and encourage active participation among stakeholders, including young people. HK$1 billion was also allocated in the 2021-22 Budget to install small-scale renewable energy systems at government buildings and infrastructure.[28]

As the government rolls out its new net-zero strategy, our survey indicates a particular need to focus on sustainable buildings and carbon-neutral vehicles and also raise citizen awareness about the importance of these areas, given their impact on Hong Kong's carbon footprint. Pollution, waste reduction and waste management, and reducing single-use plastic are seen as the most pressing sustainability challenges facing Hong Kong according to survey respondents, Meanwhile, carbon neutral buildings and vehicles were not selected nearly as often, highlighting the need for more awareness in these areas. When asked whether their city's sustainability-focused actions are sufficient, only 25 percent of respondents in Hong Kong think the city is doing enough to promote green buildings, while 19 percent say the same for carbon-neutral vehicles. Meanwhile, Hong Kong's efforts to repurpose underused buildings were considered to be sufficient by just 14 percent of survey respondents [Figure 10].

Figure 10. How Hong Kong is addressing key sustainability challenges

Citizen perception of sufficiency of current measures*

	Sufficient	Neutral	Insufficient	Average across seven Asia-Pacific markets — % perceiving as "sufficient"
Creating more open public space	25%	33%	41%	32%
Carbon-neutral buildings	25%	40%	35%	32%
Liveability and walkability of the city	22%	34%	43%	30%
Carbon-neutral vehicles	19%	34%	48%	26%
Reducing industrial air pollution and water pollution	16%	41%	43%	29%
Reducing single use plastic	16%	32%	52%	30%
Improving public transportation and reducing the number of private vehicles on the road	14%	33%	53%	24%
Repurposing underused buildings or land	14%	30%	56%	31%
Waste reduction, recycling and waste management	11%	34%	55%	27%

■ Sufficient   ■ Neutral   ■ Insufficient

*Respondent opinions on the top three issues they viewed as the most important
Source: KPMG survey analysis

> **" Buildings play a very important part because they are one of the largest generators of greenhouse gas emissions. This is one of the key areas we need to focus on to reduce our carbon emissions. "**
>
> **Graham Tier**
> General Manager,
> District Facility Services,
> West Kowloon Cultural District

Future need to retrofit existing buildings will create business opportunities

Making Hong Kong's buildings more energy efficient represents a significant opportunity area for the private sector, particularly as building owners address the growing need to retrofit existing buildings to reduce their carbon footprint. In the Chief Executive's 2021 Policy Address, the government announced new targets to reduce the electricity consumption of commercial buildings by 30 percent to 40 percent by 2050, and that of residential buildings by between 20 percent to 30 percent from 2015 levels. It wants to be halfway towards achieving these targets by 2035.[29] The challenge ahead is significant: only two percent of privately-owned buildings in Hong Kong currently carry a BEAM Plus certification of Bronze or higher from the Hong Kong Green Building Council, which evaluates sustainable building projects.[30]

In its *Unlocking value in real estate* report, real estate services firm JLL estimates that 50 percent of all investment property in prime locations across Asia Pacific is more than 20 years old, with US$40 billion of value tied up in ageing or underperforming property.[31] The study also found that rental rates were up to 40 percent lower for aged and outdated buildings compared with up-to-date well-managed properties in similar locations.[32]

There are a number of advantages to retrofitting buildings to make them more sustainable, Vella of KPMG China explains. Not only is the process more environmentally-friendly compared with demolishing them and rebuilding, but it also avoids displacing communities, while retaining older buildings provide more authentic spaces in cities.

> *We use AI-powered software to monitor the electricity consumption of buildings in real time and apply the information in helping our customers save energy.*

Austin R Bryan
Senior Director –
Innovation at CLP

Accelerating proptech innovation in Hong Kong

A range of technologies can be employed to enable buildings to be retrofitted to make them more energy efficient. Sensors, IoT, artificial intelligence (AI) and big data analysis can be used to understand a building's energy usage and reduce it.

For example, Hong Kong-based start-up Negawatt Utility improves the energy efficiency of existing buildings by digitalising traditional building management services, collecting data on energy usage and using big data analytics and machine learning to understand how energy is being used. It then uses the data to reduce energy misuse by up to 50 percent.[33]

Energy used for chilling and air conditioning can be also reduced by replacing traditional air conditioning systems with chilled beam solutions, under which chilled water is passed through tubes in a building, cooling the surrounding air and promoting airflow as warm air rises to replace the chilled air. This method is particularly energy-efficient when carried out on a large scale. In Hong Kong, a district-wide seawater cooling system has been developed for the 320-hectare urban development on the site of the former Kai Tak airport, which provides a 35 percent reduction in annual electricity consumption and carbon emissions compared with conventional air conditioning systems.[34]

The Hang Seng 113 building in Argyle Street in Kowloon is an example of how retrofitting can improve a building's sustainability. The office building was awarded the highest level Platinum certification under the US Green Building Council's LEED scheme following a renovation that included the installation of chilled ceiling and fresh air systems and energy efficient lighting.[35]

Grid edge technology enables buildings to reliably generate electricity, as well as consume it. "In the past, buildings got their energy from the grid and utilised it. Today, this flow is in both directions. Buildings can create and generate energy through solar panels, for example. They can save the energy and then decide when and how much energy they want to take from the grid, or use their own energy which they created from renewable sources, making buildings more sustainable," Elver of Siemens says. In Hong Kong, companies can use CLP's Renewable Energy Feed-in Tariff scheme to sell renewable energy they generate to the grid.[36]

To promote the uptake of proptech solutions, a number of large property developers formed the PropTech Alliance of Hong Kong in 2019. The group, which now includes most of the city's major developers, aims to promote the use of proptech through sharing solutions they are currently adopting.
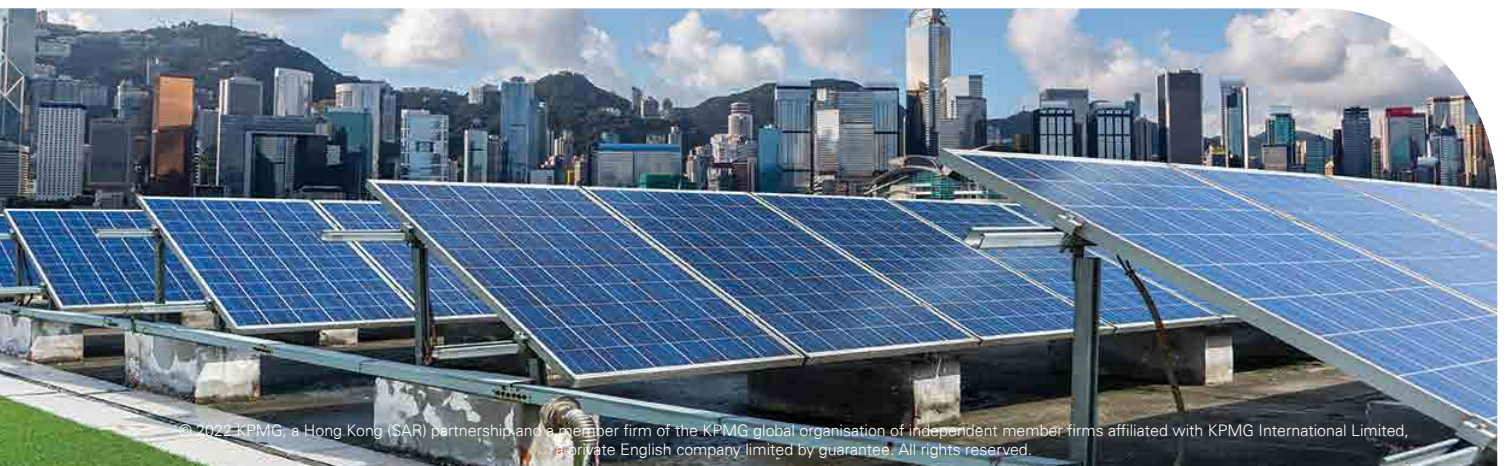
> *The Chief Executive's 2021 Policy address has a big focus on redevelopment, including planning, building approvals, land premium/zoning, revisiting plot ratio and incentives to create greener buildings that are fit for purpose. With incentives now in place, we need a concerted effort to bring redevelopment projects to life.*

Alan Yau
Head of Real Estate, Hong Kong
KPMG China

A challenge holding back retrofitting in buildings is funding, with new financing models needed, as not all retrofitting offers an attractive return on investment. Andrew Young, Associate Director, Innovation at Sino Group, a PropTech Alliance founding member, says the government could encourage developers to adopt more sustainable building practices and technology solutions, by offering non-monetary incentives, such as a shortened approval process for developers who adopt them.

Andrew Macpherson, Head of Asset Development, APAC at JLL, says updated regulations combined with incentives such as gross floor area (GFA) concessions, green loans and tax breaks could accelerate the progress of retrofitting and enhancing existing buildings in Hong Kong. Alongside retrofitting, there is also a role for repurposing existing and obsolete buildings to give them new uses and enhance the communities in which they are situated. Successful examples of this practice in Hong Kong include The Murray hotel, converted from former government offices;[37] Tai Kwun, a former police station, magistrates' court and prison, which is now a shopping, dining and arts hub;[38] and the Mills, a former industrial building converted into a business incubator, retail outlet and non-profit cultural institution.[39]

Macpherson of JLL suggests there is also a need to make more flexible and imaginative use of existing buildings. He gives the example of using buildings that are carparks during the week as venues for pop-up markets and concerts at weekends. Young of Sino Group adds that as well as being rated for their sustainability, buildings could also be rated in terms of innovation and how well they eliminated wasted space.

Reducing emissions in the transport sector

Alongside the property sector, reducing vehicle emissions represents a major opportunity for Hong Kong to reduce its carbon footprint. New goals for electric vehicle (EV) adoption will likely provide a boost for businesses in this space. In March 2021, the government published its *Hong Kong Road Map on Popularisation of Electric Vehicles,* setting out its plans for the electrification of the transport sector.[40] The government has stated that no new registrations will be allowed for fuel-propelled private cars by 2035 or earlier. The number of registered EVs in Hong Kong (not including government vehicles) reached 18,361 in 2020, more than 100 times the number in 2010. EVs currently make up around 2 percent of all cars on the road in Hong Kong, a higher proportion than comparable cities such as Seoul (0.7 percent), Tokyo (0.2 percent) and Singapore (0.1 percent).[41] Nonetheless, EVs accounted for only 12.4 percent of newly registered private vehicles in 2020.

To speed up the switch to EVs, Hong Kong aims to have more than 150,000 private EV charging facilities and more than 5,000 public ones available by 2025.[42] The HK$2 billion EV-charging at Home Subsidy Scheme is expected to help pay for 60,000 charging spaces in existing private residential buildings, while new buildings must include charging infrastructure to qualify for a gross floor area concession for carparks.[43]

> **There is an urgent need to build up Hong Kong's electric vehicle charging infrastructure – in both new developments and in existing buildings – in order to incentivise private vehicle owners to switch to EVs.**
>
> **Roy Leung**
> Head of Transport, Hong Kong
> KPMG China

The government has also allocated HK$180 million to trial single-deck e-buses, as well as establishing a HK$1.1 billion New Energy Transport Fund to subsidise trials for electric double-decker buses, medium goods vehicles and motorcycles. A further HK$80 million has been set aside to trial e-public light buses, while the government is exploring electrical vehicle models for taxis.

Public transportation players are also starting their own initiatives. The Kowloon Motor Bus Company has started an initiative to install solar panels on to the roofs of its buses, with plans to add them to more than 1,000 of its vehicles.[44] The energy generated is used to cool the bus, cutting fuel consumption for each bus by between 5 percent to 8 percent a day, and reducing carbon emissions by 6 tonnes per bus per year.

With more charging stations expected to be built in the coming decade, energy provider CLP is currently trialling a cloud-based platform that will help the company centrally manage EV charging stations to control power output. This will help to reduce the need for additional power generation during peak charging hours or when the grid faces power constraints.

Alongside the electrification of the transport sector, reducing traffic congestion also reduces carbon emissions. The Transport Department's HK$1 billion Smart Traffic Fund opened for applications for innovation and technology solutions that enhance the efficiency of the road network in March this year.[45]

In Hong Kong, Autotoll is working with Hong Kong Polytechnic University (PolyU) and the Transport Department of the Hong Kong SAR government to operate an Intelligent Transportation System (ITS) to provide real-time traffic information. The system combines three types of sensors: video detectors that collect data on traffic speed and volume at selected spots; automatic license plate recognition detectors, which provide data on the volume of different vehicle classes on the major roads; and Bluetooth detectors that capture data on average vehicle speeds and journey times. A data-driven machine learning algorithm developed by PolyU is used to integrate limited data from different sources to provide real-time estimates for traffic speeds and journey times across the whole territory. The results are displayed on road boards and the Transport Department's colour-coded speed map, enabling motorists to identify and avoid roads with congestion.[46]

Another example of innovation in this area that has been successful in other cities is Alibaba Cloud's ET City Brain, which uses big data computing and real-time analysis to process data streams from systems and sensors across an urban area to enable cities to run more efficiently.[47] First used in Hangzhou, it analysed live streams from traffic cameras, which it integrated with mapping data and traffic police accounts to visualise traffic movement in real time. This enabled the city to identify and take steps to address routine causes of traffic congestion, such as the time intervals of traffic lights. Adoption of the system citywide led to a 15 percent increase in average travel speeds, while it also halved the time emergency response vehicles took to reach their destination after the system was used to prioritise their passage through traffic. The technology has since been deployed in more than 20 cities across China.

Powering a smart city through a smart grid

Austin R Bryan
Senior Director – Innovation, CLP Group

A 'smart city' needs a smart grid that can respond to fluctuations in demand in real-time, harness insights to reduce electricity consumption and increase the use of sustainable energy, according to Austin R Bryan, Senior Director — Innovation at CLP Group, the parent company of one of Hong Kong's two major electricity providers.

The traditional energy model of generation, transmission and distribution, and the retailing of electricity is being transformed by digital enablement, Bryan explains. "Our vision for a smart grid capitalises on the heavy infrastructure investments Hong Kong has made over the years and it is part of the digital fabric of a smart, sustainable, low-carbon intensity city."

Decarbonisation, digitalisation and electrification – three keys to building a smart grid in Hong Kong

A key aspect of a smart grid is enabling buildings to not only be consumers of electricity, but to also generate renewable energy, which is then fed back to the grid. CLP's Renewable Energy Feed-in Tariff scheme, which enables companies and individuals to install solar or wind power renewable energy systems on their premises and sell the energy they generate to the grid, had received more than 15,900 applications by the end of June 2021.

At the same time, Bryan says Hong Kong's transportation sector, which currently accounts for roughly 20 percent of the city's greenhouse gas emissions, will have to undergo electrification and become an extension of the grid. He explains that this transformation creates opportunities for the owners of buildings, such as malls, that provide electric vehicle charging facilities. "They can drive traffic to their malls, making their recharging facilities an asset that contribute to their value proposition," he says.

Another top priority is reducing the carbon intensity of buildings, which account for 90 percent of energy consumption in Hong Kong. As one example, CLP worked with Airport Authority Hong Kong to develop a predictive control system for air conditioning at Terminal 1 of Hong Kong International Airport. The system monitors passenger flow and meteorological data to adjust the cooling temperature required and eliminate unnecessary energy consumption.

In addition, CLP uses artificial intelligence (AI) software solutions to monitor the energy consumption of buildings in real-time, and provide insights into how to reduce it. The company has also designed district cooling systems that enable building owners to share air conditioning with each other, such as through water-cool chillers, which can reduce energy consumption by more than 30 percent.

Increasing sustainability through GBA connectivity

Hong Kong's increased connectivity with the rest of the Greater Bay Area (GBA) also plays a key role in making the city more sustainable. A key focus is in the storage of renewable energy, such as energy generated from wind and solar farms in mainland China.

"Storage is a key part of renewable energy infrastructure, as the intermittency of wind and solar generation means without storage the energy supply would be volatile, Bryan says. "For us, storage will continue to be an exciting aspect of connectivity with the GBA."

CLP is also exploring using hydrogen as a way to reduce the carbon footprint of its natural gas power generation. Currently, CLP and GE are collaborating on advanced decarbonisation technologies for gas-fired power generation in Hong Kong, making use of low-carbon fuels such as hydrogen.

In addition, EnergyAustralia, CLP's Australian subsidiary, reached an agreement with the Government of New South Wales this year to build a new power plant capable of using green hydrogen and natural gas. It will be Australia's first net-zero-emissions power station using a blend of green hydrogen and natural gas, with direct carbon emissions from the plant offset over the course of its operating life.

Investing in sustainability: the case for proptech

Andrew Young
Associate Director, Innovation, Sino Group

Property developers in Hong Kong are facing increased demand from consumers and investors to ensure their buildings are energy efficient and resilient to climate change. As such, owners should consider the benefits of improved customer perception – as opposed to purely return on capital expenditure – when considering proptech investments, says Andrew Young, Associate Director, Innovation at Sino Group, one of the city's largest property developers.

The company is one of the founding members of the PropTech Alliance of Hong Kong, which includes most of the major developers in Hong Kong.

One example of how proptech can positively influence customer perception, Young explains, is the introduction of sanitisation and cleaning robots during the pandemic. "It is additional capital expenditure, and we don't generate extra rental income as a result. But we do show that we care for our community, our customers and our staff, which enhances how our customers perceive us. This may also be reflected in investor attitudes too, as they will see we are a responsible, creative and sustainable developer."

In addition, to demonstrate its commitment to sustainability, Sino Group is striving to achieve both BEAM Plus certification, which measures the sustainability of buildings in Hong Kong, and WELL certification, which focuses on the health and well-being of building users, for all of its new properties. Three-quarters of its projects under development currently have a BEAM Plus provisional rating. 133 PORTOFINO in Sai Kung, under the Group, was also the first residential building in Hong Kong to achieve WELL certification in 2020.

The need for incentives

As Sino Group works towards its mission to make its buildings smarter and more sustainable, Young hopes that more government incentives could be introduced to encourage developers to adopt sustainable building practices and proptech solutions.

He says these incentives do not necessarily have to be monetary, pointing out the success of the Hong Kong SAR government's initiative to allow developers to enjoy plot-ratio incentives in gross floor area for parking spaces in developments if they include electric vehicle (EV) charging facilities. That initiative had a major impact on the adoption of EV charging facilities in new residential developments.

"For example, if the government shortened the approval process by a few months for projects that adopt BEAM standards, that would reduce our capital costs and encourage adoption of these measures," he says.

Young adds that one of the biggest challenges developers in Hong Kong face is obtaining approval for the use of new technology in buildings. "If the government could relax or expedite the approval process, it would really help."

Innovation through collaboration

The Greater Bay Area (GBA) and ASEAN represent a vast market for proptech, particularly as urbanisation throughout the region continues at a rapid pace.

Hong Kong's dense population, high building standards, mature regulatory environment and position as an international hub make it well-placed to develop proptech use cases for the rest of the GBA and cities in ASEAN, Young says. But he adds that solutions must be designed for the conditions and characteristics of individual markets.

The group has set up an experimental division, Sino Innovation Laboratory, to work with start-ups and tech leaders to test proptech solutions and also concurrently develop internal innovations. Recent internal projects include the CoolJet jacket, a wearable air cooler for people working in high temperatures, and the City Air Purification System 2.0, a bus shelter that also improves the surrounding air quality for pedestrians.

The company is also trialling a window cleaning robot designed to replace human workers in gondolas, to be used in properties in Hong Kong and across the GBA. The project was identified under the PropXTech innovation programme, which is sponsored by Sino Group in collaboration with the Ping An Smart City Technology Co. Limited. In addition to cleaning buildings more efficiently and safely, the technology can contribute to greener buildings as well: "As the gondola system takes up a lot of space on the roof, if that is no longer needed, we can use that space for a green farm or rooftop garden for customers," Young says.

Improving mobility through real-time traffic monitoring

Tim Chung
General Manager of Business Development (Smart City), Autotoll

Best known for its electronic toll collection systems, transport systems provider Autotoll is developing smart mobility solutions to improve traffic flow around Hong Kong.

The company is working for the Transport Department to operate an Intelligent Transportation System (ITS) to provide real-time traffic information.

The system combines three types of sensors. The first are video detectors that collect data on traffic speed and volume and can automatically detect traffic incidents through video analytics. These are combined with automatic license plate recognition detectors, which provide data on the volume of different vehicle classes on the road through matching license plate numbers to the Transport Department's vehicle licensing system. Finally, Bluetooth detectors are used to capture data on average vehicle speeds and journey times by detecting the Media Access Control addresses - the unique identifier – of Bluetooth devices in vehicles.

The real-time data is used to provide traffic information through the Transport Department's website and mobile app so that motorists can choose the most appropriate routes, while it is also made available through the government's shared data portal data.gov.hk.

Autotoll has also developed the Traffic Control & Surveillance System for the Hong Kong end of the Hong Kong-Zhuhai-Macao Bridge. Its advanced traffic control centre combines all-rounded surveillance cameras, automatic incident detectors, lane control signals, variable speed limit signs, variable message signs, overhead vehicle detectors, speed enforcement cameras and anemometer along the road, to monitor real-time traffic conditions. The centre's state-of-the-art expert rule-based system is able to generate adaptive traffic plans in response to adverse weather conditions or traffic incidents.

"We have rich experience in telematics, and we have been applying Internet of Things solutions to fleet management to enable real-time location tracking and monitoring of vehicle status," Autotoll General Manager of Business Development (Smart City) Tim Chung says.

Free-flow tolling to further enhance smart mobility

Autotoll is also bidding to operate the government's free-flow tolling system (FFTS), which will be launched in Hong Kong in 2022, enabling motorists to pay tunnel tolls without having to stop at booths.

The system uses Radio Frequency Identification (RFID) technology, combined with Automatic Number Plate Recognition technology. Motorists will receive a vehicle-specific toll tag in the form of a sticker containing an RFID that affixes to their windscreen. The tag will store their toll tag identification number, and optionally, their vehicle identification number. The existing toll booths will be replaced with overhead toll points, which will detect vehicles as they drive under them. Automatic payment of the toll will be collected electronically from a bank account, credit card or stored value facility linked to the toll tag, and the driver will receive a notification of the payment through a mobile app.

"Autotoll offers a professional turnkey solution in design, supply, installation, testing, commissioning, and training," Chung says.

5G will be a 'game changer' for mobility, but will accelerate the need for data sharing across organisations

Chung says the increased availability of 5G will significantly accelerate Hong Kong's smart city development in the years to come.

"5G, with its high-bandwidth and low latency, enables data analytics to be used to further improve mobility," he says. That being said, a lot of data is proprietary to private companies, so these companies may need further incentives, such as favourable government policies, to share it."

Optimising smart city innovation through data sharing and collaborative tools

> *The essence of smart city is having the right infrastructure connecting the different dots in the city to allow the systems and the processes to run more effectively and efficiently.*

Fan Ho
Chief of Staff
(Central Asia Pacific)
and General Manager
(Hong Kong and Macau)
at Lenovo

The deployment of 5G across Hong Kong is well underway, with 5G coverage extending to 90 percent of the population in May 2021, and networks covering 99 percent of core business districts with high pedestrian traffic.[48] In the coming five years, increased utilisation of the city's new 5G infrastructure will facilitate new smart city use-cases, ranging from increased scope for IoT devices, to private 5G networks in companies and warehouses, to autonomous vehicles.

As Hong Kong and other cities in the region invest in technology to improve the efficiency and quality of municipal services, they also need to come to grips with how to manage the vast new amounts of data being generated. New modes of collaboration are needed to ensure city departments and private companies are adopting inclusive – as opposed to siloed – approaches to urban problems. In this respect, important elements to improve collaboration include data sharing platforms, sandboxes in which to test innovations, and a strong talent pipeline to ensure innovative enterprises have access to the workers they need.

Maximising the potential of 5G connectivity

One of the key benefits of 5G for smart city innovation is the potential for increased connectivity between different applications due to the high number of connected devices it can support. Fan Ho, Chief of Staff (Central Asia Pacific) and General Manager (Hong Kong and Macau) at Lenovo, explains: "5G is one of the critical parts of smart city because you need all the different sensors and equipment to work together, and you cannot do that without a very efficient network."

Early examples of 5G-enabled applications adopted in Hong Kong include the Smart Helmet, developed by telecom provider SmarTone. The helmet combines IoT sensors with a 5G network to monitor the location and health of construction workers in real time and generate alerts if they are at a high risk of developing heat stroke. It also notifies workers if they are wearing their helmet correctly and sends an automatic alert to a control centre if they suffer a fall.[49]

> *5G is a gamechanger when we talk about smart city innovation. It is 10 times faster than 4G and is able to support 10 times more connected devices at up to 1 million devices per square kilometre. It also has lower latency, with a turnaround time of one millisecond versus 50 milliseconds for 4G.*

Kenny Koo
Executive Director and Chief Executive Officer,
Hutchison Telecommunications Hong Kong Holdings Limited

3 Hong Kong, the mobile division of Hutchison Telecommunications Hong Kong Holdings Limited, works with start-ups through its 3InnoCity programme to provide tailored 5G/IoT solutions for its enterprise customers, with products ranging from environmental monitoring to proptech to transportation. The company says its platform provides the opportunity for start-ups to test their solutions, allowing a faster roll-out time. 3 Hong Kong also offers a certification programme under which it officially endorses start-up-developed product offerings, to help increase the visibility of these solutions in the market and among its customer base.[50]

To encourage take up of 5G by companies, the Hong Kong SAR government launched a HK$100 million Subsidy Scheme for Encouraging Early Deployment of 5G in May 2020 as part of its Anti-epidemic Fund. The scheme enables companies to apply for a subsidy of 50 percent of the cost of deploying 5G technology, up to a cap of HK$500,000.[51] Since the program's launch, more than 100 applications for innovations ranging from remote mechanical maintenance, to 3D building information modelling, to remote telemedicine applications have been approved.[52]

Despite these measures, interviewees point to the need for the government to continue to take a more active role in the execution of projects in order to encourage wider adoption of 5G solutions. "We are still in the stage of market education," says Kenny Koo, Executive Director and Chief Executive Officer, Hutchison Telecommunications Hong Kong Holdings Limited. "As more cases are realised and implemented, it will create momentum for adoption."

The need for data sharing infrastructure and governance

As the number of 5G-enabled applications in Hong Kong increases over time, it will facilitate increased levels of data collection. This data needs to be structured, stored, shared and analysed to optimise the city's smart development.

David York, Vice President Hong Kong Operations at CGI Hong Kong, thinks the biggest impact on Hong Kong's smart development will not come from new technologies, but rather the integration of all the data that is being collected. He says the two biggest challenges Hong Kong currently faces are collaboration between businesses and the government to create smart city solutions that leverage both technology and available data; and integration of these services to enable the data generated to be gathered and analysed to create new services.

Erdal Elver of Siemens explains that one way to enable large-scale data sharing between the public and private sector is to create an open-source platform that integrates the different technologies that are required for different infrastructure elements. "We need a platform that offers openness, scalability, security and useability, and which caters to the different needs and various smart city applications," he says. A data lake also needs to be created to store the data gathered through such a platform.

Ho of Lenovo says artificial intelligence and big data analytics must then be applied to the data to gain insights from it. She suggests a data sharing governance model and framework should be created to enable the exchange of data, pointing out that much of the public data is still not facilitated for exchange. "If we have a better data sharing governance model, we can facilitate more data exchange and create more intelligence by pooling and sharing data with each other. That is the angle that will really make a smart city a success."

> *With the development of smart cities, business transformation becomes common place as businesses accelerate their adoption of digital and cloud solutions. Organisations must be well-prepared to respond to increased regulatory oversight and manage existing risks such as data privacy and cybersecurity, which are becoming increasingly complex.*

Marcos Chow
Head of Technology Enablement, Hong Kong
KPMG China

> *Increasing adoption of smart city applications in Hong Kong will result in not only deeper data pools, but also greater visibility. As industries converge, the largest returns will go to businesses who best understand data and are part of the development of the next generation digital ecosystem. We now have the technology and data, but companies need to be more transparent about their use of that data as they are increasingly competing on trust with consumers.*

Anson Bailey
Head of Technology,
Media & Telecoms, Hong Kong

The Hong Kong SAR government is currently working on a Next Generation Government Cloud Infrastructure and Big Data Analytics Platform for data sharing among government departments. It is using an application programming interface gateway to increase the connectivity and information exchange between different departments and bureaux, supported by a 'digital highway' to enable real-time data exchange.[53] The platform has so far been used to verify residents' identities for the online booking system for COVID-19 vaccinations and to register for the Consumption Voucher Scheme. The government also plans to revamp its cloud infrastructure platform to enable more digital government services, as well as to facilitate collaborations and partnerships between government departments, IT services providers and other third-party entities.[54]

As initiatives are developed, Paul Lam, Strategy Officer (Digital & Technology) Asian Infrastructure Investment Bank, stresses the need for governance on data sharing: "If we don't set up common rules and platforms, everyone will create their own siloed incompatible infrastructure assets in different parts of the city with bespoke data models and inconsistently referenced data libraries." Not only does there need to be collaboration on pooling data, but data also needs to be distributed in a standard way to enable citizens to access it easily.

Although data sharing and pooling is still in an early stage in Hong Kong, privately-developed apps are starting to incorporate public transportation data to make them more useful to consumers. One example is WIL, an app for motorists launched in September 2021 in Hong Kong by Let's Go Limited under Wilson Group, one of the city's major parking providers. The app gathers useful information on the road from designated car parks, speed cams and electric vehicle charging stations and fuel stations, on top of the latest car-related services in town such as car wash, auto repair, and towing services for its members.[55]

Enabling 'sandboxes' to more effectively test new innovations

Alongside increased data sharing and analytics capabilities, there is also a need for a regulatory regime that allows for innovation. Sandboxes, or closed virtual environments for software developers to test new applications, play a crucial role in enabling innovators to pilot their products and gather data and feedback on them.

Hong Kong has had a Fintech Supervisory Sandbox since 2016, which allows firms to conduct pilot trials without achieving full regulatory compliance.[56] The Financial Services and Treasury Bureau also launched the Fintech Proof-of-Concept Subsidy Scheme[57] in early 2021, offering fintech firms funding of up to HK$100,000, rising to HK$150,000 for more complex projects, to test new applications, while also encouraging established financial institutions to partner with them.

Eric Chan of Cyberport points out that as sandboxes often use real data, it is important to have data security measures in place to ensure that data is protected during the pilot phase.

In addition, the former airport and industrial area in Kai Tak, in Hong Kong's Kowloon East district, is being used as a pilot area to run proof-of-concept trials for smart city solutions, including real-time energy consumption monitoring, illegal parking detection, and a smart recycling bin system.[58]

Despite these sandboxes being in place, there is still demand from companies to have more opportunities to test their solutions at an early stage. Kenny Koo of Hutchison Telecommunications Hong Kong Holdings Limited explains that sandboxes are also important to help governments understand the technology being used to enable them to make appropriate changes to regulations. He gives the example of autonomous vehicles: "We have to provide the technical know-how and different pilot scheme results to the government to let them know exactly how it works, so that they can understand the technology and reform the regulations."

> *Corporates should adjust their mindset to see start-ups as partners rather than service providers or vendors, or even competitors. This change requires viewing innovation as something that should permeate an entire organisation, as opposed to a single department or office. It also requires more focus on value rather than return on investment, taking a longer-term view to build a competitive advantage using technology.*

Irene Chu
Head of New Economy,
Hong Kong
KPMG China

"*As the pace of technological development intensifies, cities like Hong Kong need to be clear and adaptive in their regulatory approach if they are going to realise the full benefits of digital transformation.*"

Susheela Rivers
Hong Kong Managing Partner
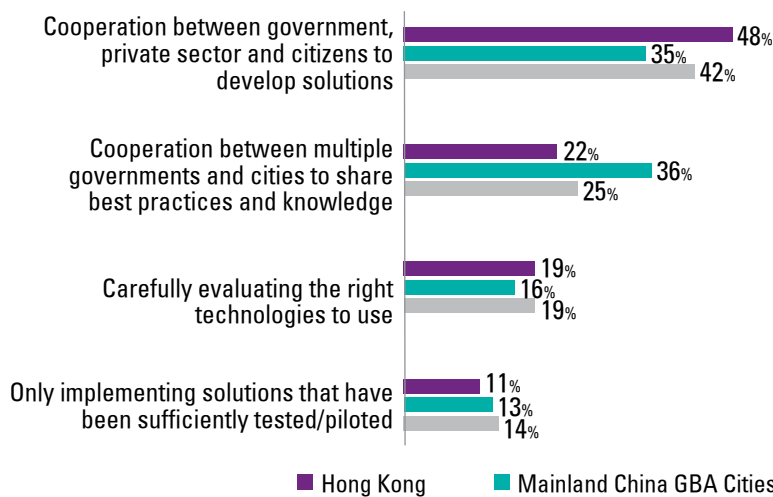Global Co-Chair Real Estate Sector
DLA Piper Hong Kong

Public-private-people partnerships should also extend to educational institutions

The need for collaboration to aid smart city development is reflected in our survey results. Nearly four out of 10 (39 percent) survey respondents across all markets think responsibility for co-developing smart city solutions should be shared between the public sector and NGOs, followed by 32 percent who think private business should take the lead [See Figure 11].

In Hong Kong, cooperation between government, private sector and citizens was seen as being the most important factor to ensure smart city solutions are impactful, cited by 48 percent of respondents. Cross-government and cross-city cooperation to share best practices and knowledge was listed as the most important factor among respondents in mainland China GBA cities at 36 percent. Carefully evaluating the right technologies to use was listed as one of the top three priorities by 78 percent of all respondents, while 18 percent considered it to be the single most important factor.

Figure 11. Most important factors to ensure smart city solutions are successful and impactful

Among citizens polled*

Factor	Hong Kong	Mainland China GBA Cities	Other Asian Markets
Cooperation between government, private sector and citizens to develop solutions	48%	35%	42%
Cooperation between multiple governments and cities to share best practices and knowledge	22%	36%	25%
Carefully evaluating the right technologies to use	19%	16%	19%
Only implementing solutions that have been sufficiently tested/piloted	11%	13%	14%

How should the responsibility for co-developing solutions be shared?

- Public Sector & NGOs — 39%
- Private Businesses — 32%
- Citizen Engagement & Consultation — 29%

Source: KPMG survey analysis of citizens in seven Asia-Pacific markets

*Respondents ranked the above factors in order of importance
Source: KPMG survey analysis of citizens in seven Asia-Pacific markets
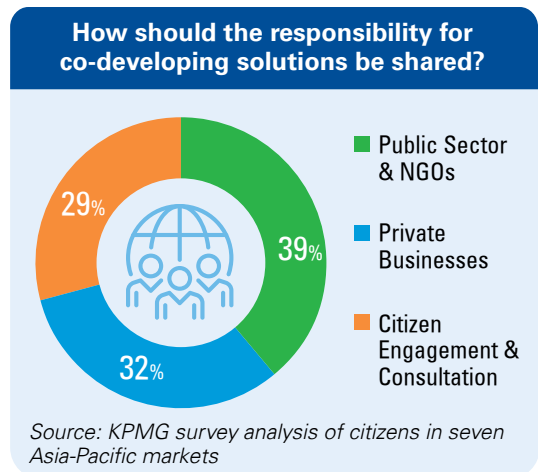
In KPMG's previous *Future Hong Kong 2030* report, the findings showed that businesses are keen for more opportunities to collaborate with government. In that study, a majority of percent of public and private sector executives surveyed said increased willingness of government departments to collaborate with the private sector would play an important role in Hong Kong's smart city development.[59] Ho of Lenovo also stresses the importance of corporates collaborating with start-ups. "Start-ups are a lot more agile, flexible and have a quick turnaround time. They can do an excellent job at addressing a particular issue. We believe companies can't do everything by themselves, so we need to leverage each other and partner with each other."

In addition to the government, businesses should also look for collaboration opportunities with Hong Kong's universities. "Hong Kong can leverage the world-class educational institutions to create much more powerful solutions," Djoann Fal, Co-founder and CSO of technology talent network GetLinks.

Tim Chung of Autotoll agrees: "Public-private partnerships (PPPs) are not limited only to government and private company cooperation; private companies should also partner with higher education institutions and universities as well."

Data exchanges critical to Hong Kong's future smart city transformation aspirations

Fan Ho
Chief of Staff (Central Asia Pacific) and General Manager (Hong Kong and Macau), Lenovo

Sharing data among government departments, enterprises, and the public is essential for Hong Kong to realise its potential as a smart city in the years ahead, says Fan Ho, Chief of Staff (Central Asia Pacific) and General Manager (Hong Kong and Macau) for technology provider Lenovo.

She explains that the objective of smart city projects should be to make the delivery of government services more effective and efficient. In addition, they should support commercial development by enabling new business models and make cities more sustainable from both an environmental and a social point of view.

"Data is critical to adding a layer of intelligence to the whole smart city infrastructure. We need to make valuable data available without impinging data privacy and confidentiality," Ho says.

Ho suggests that the Hong Kong government go beyond current regulations and look into data exchanges that run on a solid data governance framework and standardised protocols. These exchanges can pool structured and unstructured data from the public and private sectors in data lakes, which artificial intelligence (AI) programs can analyse to extract insights.

When 'smart city' and 'Industry 4.0' intersects

Ho explains that data exchanges can increase access to data, enabling businesses to benefit from an added layer of intelligence and explore new models. They can also help manufacturers to embrace the 'Industry 4.0' concept.

Individual businesses or manufacturing facilities currently use AI and automation in silos to enhance their operations. Ho gives the example of a beverage bottling factory using sensors to monitor production quality and automate the packing of crates.

"In the Industry 4.0 model, this manufacturer would leverage data from the external world, as well as feeding its data into data exchanges, enabling smart city and industry to intersect."

Such an approach will allow the same bottling company to improve the efficiency of its supply chain using inventory data shared by a supermarket chain, for example. As a result, the company can optimise its manufacturing capacity or replenishment schedules based on real-time inventory data.

"That is how the last piece of efficiency comes into play. You are leveraging the collective wisdom of the whole city to make it run more effectively and efficiently. If we can use data exchanges to enhance the city's data-sharing capabilities and expand access to datasets, there will be a lot of opportunities," Ho says.

Key technologies that smart cities need

Looking ahead, Ho points out five key technology areas that will be indispensable for smart city development: client endpoint devices, edge computing, the network, the cloud and intelligence.

Client endpoint devices, ranging from computers and sensors to wearable devices, bridge the physical and the digital worlds. As more things become connected, edge computing, a system that brings computation and data storage closer to the data source, will also be crucial for keeping the turnaround time between processing and transmitting insights back to the endpoints short.

The network and the cloud are needed to transmit and store the data generated by sensors and other endpoint devices. 5G will be vital to improving network speed, reducing latency, and enabling more devices to be connected while the cloud can collate and store the data.

Finally, a layer of intelligence must exist to make sense of all the data collected in a smart city. This intelligence can be achieved through using AI, big data analytics and machine learning.

"The realisation of a truly 'smart' city depends on these five technologies and being able to facilitate better data exchanges. When you have that, what is possible is then really down to the imagination."

Living labs: The power of real-time collaboration

Waltraut Ritter
Founder, Knowledge Dialogues

Building smart, green, resilient and connected cities requires holistic and evolutionary planning, adaptation and experimentation involving a wide range of players with different types of knowledge and experience.

One way that public and private sector players can collaboratively address urban challenges together with citizens are through 'living labs', ecosystems where solutions can be developed and tested in real-life environments.

Some living labs may be built within city districts to work on specific needs and aspirations of people living in the area, while others may be at universities to work on urban themes to experiment with ideas on sharing and circular economy. The centres allow pilots to be tested quickly tested and fail/succeed in a real environment.

In a true 'living lab', citizens are at the centre of innovation because their understanding of local context and culture is key to the process of planning. For example, if a new metro station is built, the future services and facilities should be planned collaboratively with citizens, government and developers, so that the station can improve the lives of residents.

Creating a successful living lab

To create a well-functioning living lab requires both physical and digital space as well as a long-term commitment among organisations involved.

The European Network of Living Labs list five elements for a successful setup as follows:[60]

Active user involvement: empowering end users to thoroughly impact the innovation process

Real-life setting: testing and experimenting with new artefacts "in the wild"

Multi-stakeholder participation: the involvement of technology providers, service providers, relevant institutional actors, professional or residential end users

Multi-method approach (i.e. a combination of methods and tools including ethnography, psychology, sociology, strategic management and engineering

Co-creation (i.e. iterations of design cycles with different sets of stakeholders)

Bringing living labs to life in Hong Kong

Hong Kong has begun to embrace the living lab concept in recent years — examples include Hong Kong Science and Technology Park's Smart Campus, and corporate innovation hubs set up by MTR and property developers such as New World.

However, more can be done to make initiatives more inclusive and collaborative. Gene Soo, Head of Ecosystem at MTR, says that companies should "challenge themselves" to work together to tackle the city's most pressing urban problems.

"Without increasing the capacity and willingness to experiment, the connectivity between business, government and citizens will not be strong enough to produce sustainable urban solutions at scale," Soo says.

An early example of the living lab – Urban Mill in Espoo, Finland

One of the pioneers of the living lab concept was Urban Mill in the city of Espoo, Finland, founded in 2013. The project brought together over 5,000 researchers and 25 R&D organisations to collaborate on urban initiatives.[61]

The community features a cloud-based "launch pad" where start-ups could present pitches and work with larger businesses on targeted solutions. At the core of this new type of public-private-people partnership are Aalto University, the Finnish Architects and Engineers Association, the City of Espoo and its residents.

Kari Mikkelä, one of the founders, sees the "Espoo innovation garden" as one of the outcomes of the continuous collaborative efforts, which turned this part of the city into a leading regional innovation hotspot in Northern Europe. Mayor Jukka Mäkelä says: "The best resources in Espoo are its residents, communities and companies. Active involvement of residents in the development of our services and our comprehensive cooperation with partners ensure effective services that meet the needs of the residents."

For the complex urban challenges lying ahead, living labs can help all stakeholders involved how to think in ecosystems.

Photo credit: Urban Mill

For more information on the City of Espoo's strategy, please visit https://www.espoo.fi/en/city-espoo/espoo-story.
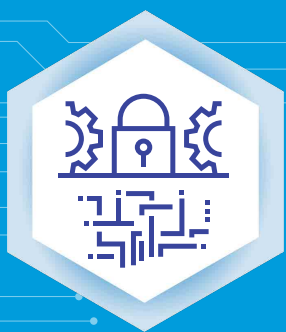
Comprehensive data security governance is needed to safeguard Hong Kong's digital ecosystem

> *The protection of critical national infrastructure, such as water and energy supply and nuclear reactors, is no different to any other cybersecurity issue. You need secure operations centres that constantly monitor cyberattacks and also physical attacks. You have to bring those two things together.*

David York
Vice President
Hong Kong Operations at
CGI Hong Kong

The importance of data security is a leading concern for organisations as connectivity increases through the rollout of 5G and IoT on everything from consumer homes to critical government infrastructure.

The increased incidence of ransomware attacks, under which companies and even governments have their systems disabled, or are threatened with data leaks if they do not pay a ransom, also highlights the need for robust cybersecurity regimes at government level.

Timothy Mak, General Manager, Hong Kong and Macau at Signify, says: "If you are using IoT on streetlights and someone hacks it and switches them off, it will impact everyone. Likewise, if you have an IoT device in your home, you don't want someone to be able to hack it."

Although consumers we polled have shown an increased willingness to share their data during the COVID-19 pandemic, data security and privacy remains a key concern for many people, highlighting the need to have strong data protection measures in place. Ensuring data security, in addition to data privacy, was seen as the third most important factor to consider when cities implement new initiatives by survey respondents in Hong Kong, cited by 55 percent, while it was seen as the second most important factor by those in Mainland China GBA cities and other Asian cities (See Figure 12).

Figure 12. Key factors to consider as cities implement new initiatives

Among citizens polled

Factor	Hong Kong	Mainland China GBA Cities	Other Asian Markets
Impact to improve society and the well-being of residents	63%	54%	53%
Effective, transparent and proactive communication and consultation with citizens	61%	68%	58%
Ensuring citizen data security and data privacy	55%	58%	59%
Cost effectiveness and prudent use of public resources	52%	51%	55%
Projects that are carbon-neutral or can reduce the city's carbon footprint	40%	36%	39%
Projects that can make the city more resilient to climate change	29%	34%	35%

■ Hong Kong ■ Mainland China GBA Cities ■ Other Asian Markets

Source: KPMG survey analysis of citizens in seven Asia-Pacific markets

The need for a coordinated approach to cybersecurity

As Hong Kong's adoption of 5G and connected IoT in smart city infrastructure continue to accelerate, Hong Kong needs to continue to improve cybersecurity regulations in order to ensure systems are secure, resilient and recoverable. "Over the years, the enactment of cyber laws in mainland China, Macao SAR, Singapore and the EU have allowed for a consistent approach to security and protection when it comes to critical infrastructure within those jurisdictions," explains Henry Shek, Head of Cyber Security, KPMG China.

For example, the Cybersecurity Act in Singapore establishes a legal framework for the oversight and maintenance of national cybersecurity, covering critical information infrastructure (CII), such as energy, water, banking, healthcare and transport, with a framework setting out the obligations of owners to proactively protect CII from cyberattacks.[62] It has also set up the Cyber Security Agency of Singapore to co-ordinate cyber security efforts across the city-state.[63]

In Australia, the Parliamentary Joint Committee on Intelligence and Security recommended to expand the number of sectors considered as "Critical Infrastructure" in order to help protect the country from the increased threat of cyberattacks.[64] Another leader in this area is Estonia, which has produced three national cybersecurity strategies since suffering a significant attack in 2007. Its most recent strategy document features principles of security and privacy for the public and private sector to follow, which are supported by a central security architecture authority.[65]

The case for industry-wide data security standards

Interviewees for this report suggest further development of industry-wide security standards for IoT devices and projects. These standards should cover the devices themselves, the data lakes in which the data they generate is stored, and the network used to transmit data between the two points. End-point devices should have encryption abilities, backed by a certification scheme so that consumers know the devices they are purchasing are protected. It should also be possible for the software of these devices to be continuously upgraded to stay ahead of the latest security threats.

"What we see as one of the biggest barriers is how to make available really valuable information without impinging data privacy and confidentiality."

Fan Ho
Chief of Staff
(Central Asia Pacific)
and General Manager
(Hong Kong and Macau)
at Lenovo

Mak of Signify points out that end-point devices can be used as an entry point to the whole network. "The only way to avoid [cyberattacks] is through continuous enhancements of the product's software." He adds that Hong Kong currently lacks a standardised approach, meaning individual projects have their own standards of security.

Examples from other jurisdictions include the Singapore Common Criteria Scheme, overseen by the country's Cyber Security Agency. Developed with national security and standards organisations from Canada, France, Germany the Netherlands, the United Kingdom and the United States, it offers certification that all IT products meet a set of international security standards.[66] Meanwhile the European Union has put in place the Cybersecurity Act establishing a cybersecurity certification framework for ICT products and services, overseen by ENISA, the EU Agency for cybersecurity.[67]

In Hong Kong, the Smart City Consortium is developing a set of indexing standards, cybersecurity guidelines and best practices for IoT proptech devices in partnership with Chinachem Group.[68] The Hong Kong Computer Emergency Response Team Coordination Centre has also published a set of IoT Security Best Practice Guidelines. While these initiatives are positive steps towards the development of security standards in Hong Kong, formal standards will likely be necessary to improve consumer trust.

"As Hong Kong's adoption of 5G and connected IoT continue to accelerate both within the smart city infrastructure and within the private sectors, holistic implementation of security standards will be needed to ensure our own infrastructure, while connected, is secure, tested, resilient and recoverable."

Henry Shek
Head of Cyber Security
KPMG China

IoT security: the case for standardisation

Timothy Mak
General Manager, Hong Kong and Macau, Signify

Internet of Things (IoT)-enabled networks hold tremendous promise for cities and businesses to improve the efficiency of their operations and respond to issues in real time. However, inconsistencies in the hardware and software currently used in cities can make such systems vulnerable to cyberattacks, according to Timothy Mak, General Manager, Hong Kong and Macau, at lighting company Signify.

Mak explains that there are two key aspects to IoT security: the devices themselves and storage of the data they collect. He sees IoT devices as being a potential weak point in a security system, as they could be used by hackers as an entry point to the network.

"The current lack of standardisation means different IoT vendors and projects have their own approach to security. This makes it harder to protect systems from cyberattacks, as well as share the data they generate," Mak says.

Standardising IoT data transmission

One area in which Mak would like to see standardisation is the way in which data is transmitted from IoT devices to cloud data centres. He points out that different providers use different means, such as Wi-Fi, MBR narrowband, ultra-wideband and Long Range Wide Area Network (LoRaWAN).

The situation not only makes it harder for standardised security requirements to be put in place, but it can also mean that the data collected is not easily shared.

Mak adds that as more sensors and IoT devices are installed across Hong Kong, it is important that the data gathered is shared through an open ecosystem.

"IoT devices help the city to become faster. But the ecosystem needs to be opened up. We need an open API [application programming interface] so that we can exchange data. I strongly believe the government can play a very important role in assisting that."

The need for constant updating and automated monitoring

As cyber risks are constantly evolving, the software of IoT devices needs to be constantly updated. Because of this requirement, Signify has opted to use an open standard solution for its devices, rather than a proprietary one, as its R&D capacity is not focused on the constant refinements that are needed in this area.

"Our IoT devices are designed with encryption abilities so that they are protected, while for our data lake we partner with advanced players like AWS and Google Cloud Platform to provide a secure cloud environment," he says.

He adds for Hong Kong's Smart Roadlight project, in which Signify is involved, it will use an ultra-wideband connection to transmit data, as this functions like a private network, further enhancing security.

At the same time, Mak says artificial intelligence (AI) and machine learning have a critical role to play in improving IoT security. He points out that with potentially hundreds of millions of IoT devices being used in the future, AI will be needed to monitor the performance of devices and identify potential security breaches or cyberattacks.

Coordinating public and private data security efforts

At present, the Hong Kong Computer Emergency Response Team Coordination Centre, which is managed by the Hong Kong Productivity Council, has established IoT Security Best Practice Guidelines which aim to give developers a basic understanding of common security issues.

However, Mak would like to see these efforts taken a step further, with a government-led consortium that could bring different vendors together to create a standardised approach to security.

This could include the development of a certification scheme for IoT devices, setting out minimum security standards. He suggests industry committees should be set up to create these certification standards, and vendors could be required to meet them as part of the bidding process for government contracts.

"If a framework is developed and everyone has guidelines to follow, the approach to security could be more coordinated and strategic," he says.

Opportunities for Hong Kong to develop best practices for the rest of the GBA and ASEAN

In this year's study, we discuss three key areas where Hong Kong is particularly well-suited to develop products and services that can serve as models for other markets in the region: 1) logistics and digital supply chain; 2) proptech; and 3) fintech, Regtech and sustainable finance.

Logistics and digital supply chain

Hong Kong already serves as a supply chain and logistics hub for the re-export of goods between mainland China and ASEAN and has the conditions needed to develop and test logistics solutions before exporting them. It is home to the government-funded Logistics and Supply Chain MultiTech R&D Centre, based at Cyberport, which supports local innovation. There were roughly 385 e-commerce, supply chain management and logistics technology start-ups in Hong Kong at the end of 2020, making it the second largest innovation and technology sector in the city after fintech.[69]

Hong Kong International Airport (HKIA) is consistently ranked as one of the busiest cargo airports in the world, and its status as an aviation hub will be further strengthened when the airport's new three-runway system goes into operation in 2024.[70] In addition, the Airport Authority plans to set up a HKIA Logistics Park in Dongguan and an intermodal cargo facility at HKIA to increase cargo handling volumes and enable customs clearance, security screening and other services to be completed for mainland China exports in Dongguan before being transferred to HKIA.[71]

The COVID-19 pandemic has shown companies the benefits of digitising their supply chains. It has also driven an increase in e-commerce, reflected in our survey results, highlighting the need for technology applications that can increase capacity and optimise efficiency at warehouses and distribution centres.

Key technologies for the logistics and supply chain sector are AI, data analytics, automation, 5G and IoT. One company innovating in this area is Geek+, which has based its Global Research & Development Centre at Hong Kong Science Park. It uses AI and advanced robotics to create automated warehouse solutions using robots for product retrieval and sorting, increasing operational efficiency by nearly 10-fold compared with using people.[72] Another example is Cyberport-based start-up Chain of Demand which uses machine learning to create predictive analysis models to help companies predict consumer demand for their products and plan accordingly. The city has already made strides in the push for paperless commerce with its Trade Single Window, an electronic platform that enables registered users to lodge 14 types of import and export trade documents with the government, with a further 28 types of documents due to be added in phases from 2023.[73]

Technology can also help companies as they place an increased emphasis on supply chain transparency. In a KPMG global survey published in November 2021 of over 200 apparel brands and suppliers, of which 59 percent were based in Asia Pacific, more than half said corporate reputation was a key driver to implement supply chain transparency, while approximately one-third cited customer expectations and investor/shareholder pressure.[74]

Despite this, the majority of companies surveyed said the information they disclosed for supply chain visibility and traceability was manually tracked, with less than half of companies having semi-automated or fully automated systems. The study uncovered a significant appetite for investment in this space, with around one in four companies

planning to invest US$1 million or more in building supply chain transparency in the coming three years, suggesting there are significant opportunities in this area for technology providers. KPMG's recent *Future of Sourcing: 2021 and beyond* report also highlights the need for companies to have supply chain visibility to avoid the so-called bullwhip effect, under which a slight surge in demand from customers at one end of the supply chain can lead to a disproportionate increase in orders received by suppliers at the other end, leading to excess inventory and waste.[75]

As the trend towards demand-driven supply chains continues, companies in Hong Kong are in a strong position to provide supply chain solutions. Pat Woo, Global Co-Chair for Sustainable Finance, KPMG, says: "Hong Kong has a deep pool of sourcing and supply-chain expertise, and the capacity to apply new technologies in ways that can transform outmoded practices. The data and knowledge for managing the supply chains of the future is here."

Advanced data analytics can also be used to stress-test supply chains. KPMG offers a model that uses an organisation's own data to demonstrate the impact potential disruptions could have on existing or new supply chains, and identifies contingency measures that could be taken to mitigate them.[76] With global disruption events becoming more frequent, complex and harder to predict, there is a greater need for scenario-based assessments that can help businesses improve their resilience and agility.

Digital technologies, enhanced specialisation help to reduce food supply chain costs for GBA-based companies

Supply chain disruptions caused by the COVID-19 pandemic have provided massive logistical challenges for global food importers. However, basing operations in the Greater Bay Area (GBA) has proved to be advantageous for food distributors looking to sell to mainland China, Hong Kong and ASEAN countries.

Dr. Abel Pereira, CEO of Ba Hong Lung (Red Wings), has been importing meats and frozen foods from Brazil into Greater China for over 20 years, and has based his logistics operations in the GBA for the past decade.

Pereira notes the tremendous improvements in digitalisation and infrastructure in the GBA in recent years which have enabled his company to reach more customers and reduce logistics costs.

As reported by Hong Kong Trade Development Council, in this interconnected system, Guangdong operators can partner with Hong Kong and Macao logistics companies to enhance their import capacity of chilled / frozen products by upgrading their cold chain logistics services. Many leverage the management experience of their Hong Kong partners, particularly in areas such as quality control and RFID/QR based tracking and tracing solutions to enhance monitoring and inspection of cold chain transportation in order to improve goods storage, transhipment and last mile delivery.[77]

"These days, food supply chain logistics is highly specialised, and this has helped enormously to reduce transportation costs for producers like us as well as consumers," Pereira says.

Proptech

Hong Kong has a thriving proptech scene with many innovative products being tested in the city. Hong Kong start-ups operating in this space include Negawatt Utility, which uses big data analytics and machine learning to understand energy consumption in older buildings. By digitalising traditional building management services, it is able to reduce energy loss by up to 50 percent.[78] In addition, Hong Kong-based Ampd Energy has created the Ampd Enertainer, an advanced energy storage system to replace noisy diesel generators on construction sites with a lower emissions alternative.[79]

Other proptech applications being developed in Hong Kong range from window cleaning robots being trialled by Sino Group, to augmented reality inspection and maintenance platforms being developed by JLL, to companies harnessing IoT to make homes smarter and enable residents to adjust thermostats and lighting remotely.

Many cities across the GBA and ASEAN share similar challenges to Hong Kong, such as the need to reduce carbon emissions from the built environment and the requirement to retrofit older buildings. As both businesses and countries in the region set net-zero carbon targets, demand

for technology applications that can help make older buildings more energy efficient is expected to increase. For example, Singapore has set a target for 80 percent of buildings by gross floor area to meet green energy performance targets by 2030.[80] As other markets in the region start to set similar targets, Hong Kong proptech developers may be well-positioned to capture market opportunities.

Andrew Young of Sino Group points out that Hong Kong's high regulatory standards make its products attractive to other markets. "Hong Kong is uniquely poised in the GBA and ASEAN community. We are very well built and well-regulated in Hong Kong and that regulation is a sign of our assurance," he says.

Young also emphases the importance of adapting solutions developed in Hong Kong to meet the needs and characteristics of individual cities, which while they may share many similarities with Hong Kong are also likely to have their own challenges that require addressing. "Adapting technology to suit the local landscape is important," he says.

Fintech, Regtech and sustainable finance

Hong Kong's status as an international financial centre with more than 468 fintech start-ups[81] puts it in a prime position to develop fintech use cases that could be applied to the rest of the GBA and ASEAN. Companies exploring this area can also benefit from the Hong Kong Monetary Authority (HKMA) FinTech Supervisory Sandbox,[82] launched in 2016, and the Financial Services and Treasury Bureau's (FSTB) Fintech Proof-of-Concept Subsidy Scheme,[83] launched earlier this year.

Eric Chan of Cyberport points out that many solutions developed in Hong Kong can support multiple currencies, meaning they can easily be applied to other locations. He gives the example of TNG Fintech Group, whose e-wallet, which enables real-time fund transfers, originally launched in Hong Kong and has since expanded into 12 countries across Asia.[84]

The city is also in a strong position to export Regtech – the use of technology to enhance the efficiency of risk management and regulatory compliance. Hong Kong's own high regulatory standards, as well as the high number of multinational corporations based in the city, means there is a high level of understanding of compliance requirements in other markets.

Transforming Risk Management and Compliance: Harnessing the Power of Regtech, a white paper produced by KPMG and the Hong Kong Monetary Authority (HKMA), outlines next steps for Hong Kong to become a global leader in Regtech and a hub for nurturing talent in this area.[85] The paper identified six broad areas for in which Regtech applications should be developed, namely Regulatory Compliance Obligations, Financial Crime, Conduct & Customer Protection, Regulatory & Tax Reporting, Risk Management, and Governance & Accountability. On the demand side, The *Regtech Adoption Index 2020*, also produced by KPMG and HKMA, found that banks are most likely to be using Regtech to address Financial Crime, at 69 percent, while 47 percent are using it for Risk Management and 35 percent for Conduct & Customer Protection.[86]

The growing complexity of financial services regulation means banks and other financial services firms are increasingly turning to technology solutions both to ensure they comply with all of the relevant regulations and to reduce costs and increase efficiency in this area of their operations, with the *Regtech Adoption Index 2020* finding that most banks are currently using at least some form of Regtech in their operations.[87] However, barriers to further adoption include a lack of funding, a lack of awareness of the value of Regtech solutions, and low readiness in terms of banks' own infrastructure.

Accordingly, educating financial institutions about the importance of Regtech and other areas of fintech, and attracting top talent are two important elements to ensure the healthy growth of these sectors in Hong Kong.

> " *Developing a diverse set of skills among the workforce is critical to the successful adoption of Regtech solutions.* "

Alva Lee
Head of Governance,
Risk & Compliance Services,
Hong Kong
KPMG China

> *We need more traditional financial institutions to understand what fintech is and embrace it. Only then will fintech companies have the chance to convince financial institutions to adopt fintech solutions.*

Eric Chan
Chief Public Mission Officer,
Cyberport

On the talent side, one initiative is the FinTech Anti-epidemic Scheme for Talent Development (FAST), launched in 2020. Administered by Cyberport, the HK$120 million initiative offers local companies a subsidy of HK$10,000 per month to create new fintech jobs, with the aim of creating 1,000 new jobs to build up Hong Kong's talent pool.[88]

Cyberport also offers a FinTech Training Programme for financial practitioners. The workshop series was attended by more than 1,200 financial executives from 49 financial institutions in its first year. The course covers areas such as blockchain, digital assets, cybersecurity and Regtech.[89]

Going forward, more needs to be done to ensure financial institutions are equipped with the necessary skills that will enable Regtech adoption. The HKMA's Regtech Skills Framework, designed in collaboration with KPMG, was released in October 2021 in a report which recommended establishing an enhanced competency framework that would, among other improvements, establish an accreditation system for education programmes to provide clear guidance to training providers and learners.[90]

"The adoption of Regtech changes the way in which people, machines, and business processes interact. It involves fundamental changes to business and operations which cannot be fully accomplished with technology skills alone. Therefore, developing a diverse set of skills among the workforce is critical to the successful adoption of Regtech solutions," says Alva Lee, Head of Governance, Risk & Compliance Services, Hong Kong, KPMG China.

Lastly, as environmental sustainability becomes increasingly important to both governments and businesses, and green building and infrastructure projects become more mainstream, new financing solutions will be required. This represents an opportunity for Hong Kong to develop as a best practices hub for sustainable finance solutions and products.

As pointed out in KPMG's 2021 *Hong Kong Banking Report*, the city has the expertise necessary to play a major role in many areas related to sustainable finance, from establishing cross-border carbon markets to the use of blockchain technology for monitoring green assets. It can also play an important role in developing relevant accountancy and ESG disclosure standards.[91]

In May 2020, the Green and Sustainable Finance Cross-Agency Steering Group was formed to come up with a coordinated strategy for Hong Kong's finance sector, chaired by the HKMA and the Securities and Futures Commission. In December 2020, the Steering Group issued a strategic plan aimed at making Hong Kong SAR into Asia's green finance hub.[92] This was followed by the Hong Kong Stock Exchange (HKEX)'s launch of the Sustainable & Green Exchange (STAGE), an online portal providing information, access and transparency on sustainable green and social investment products.[93]

While HKEX-listed companies have been required to disclose ESG data since 2016, STAGE represents a new tier of visibility for investors that will reinforce Hong Kong's position as a best practices hub.

> *While ESG information continues to improve, challenges remain for the availability and quality of ESG data across the Asia Pacific region. Data quality is critical to the success of any sustainable finance hub. With its strong regulatory regime and the structure of its capital markets, Hong Kong will play a major role in improving sustainable finance in the region for years to come.*

Pat Woo
Global Co-Chair for Sustainable Finance, KPMG

'Playing, failing and adapting': leveraging sandboxes to drive fintech innovation

Eric Chan
Chief Public Mission Officer, Cyberport

To effectively develop technology solutions that can benefit the broader business community, Hong Kong's fintech start-ups need access to 'sandboxes' where they can test and refine their products and gather data and user feedback to accelerate the innovation process.

Eric Chan, Chief Public Mission Officer of Cyberport, a major innovation and technology incubator wholly owned by the Hong Kong SAR government, says two types of sandboxes are critical for Hong Kong start-ups. The first type, known as a regulatory sandbox, enables financial institutions and partnering technology firms to conduct pilot trials without the need to achieve full regulatory compliance before the fintech solutions are officially launched. The second allows developers to test innovative fintech models or solutions. In this preliminary stage, if products are found to be suitable for the market, they would proceed to regulatory sandbox testing as a next step.

To help meet the need for the second type of sandbox, Hong Kong's Financial Services and Treasury Bureau (FSTB) launched the Fintech Proof-of-Concept Subsidy Scheme (PoC Scheme) earlier this year.

The scheme, which is administered by Cyberport, offers fintech firms funding of up to HK$100,000 to test their solutions, rising to HK$150,000 for more complex projects, such as those involving cross-sector or cross-border applications. At the same time, it encourages established financial institutions to partner with these firms.

Chan explains that start-ups often found it difficult to find a sponsoring institution to provide them with the environment in which they can conduct pilot trials. The PoC Scheme helps fill the gap and encourages start-ups to test and implement innovative and practical solutions. "The endorsement of the FSTB means financial institutions are now eager to support these PoCs, providing an environment, data and resources for testing." He adds that to-date, 93 out of over 160 valid PoC Scheme applications have been approved, involving grants totalling over HK$10 million.

Providing a playground for developers

Aside from fintech, to facilitate start-ups in other sectors to test new products, Cyberport offers a data service platform that serves as an sandbox for start-ups to test their solutions in a secure environment with nearly real data sets. "We have to encourage people to try new things, even though not all of them will work. We have to allow fast failure and fast adaptation," Chan says.

Cyberport has also created a 5G environment in its smart living cluster to enable companies in its community to test their 5G innovations. "We are seeing many innovations in areas such as virtual reality and gaming, interactive learning and manufacturing processes," Chan says.

For example, one company, Kamakura Foods Limited, is currently using 5G to manage its Wada Bento vending machines remotely. The machines enable workers at Cyberport to pre-book a bento lunchbox, which they can claim by presenting a QR code to the vending machine. The hot lunch is then delivered to them in 17 seconds. The technology has since been exported to Japan.

Exporting fintech and Regtech innovation

As an international financial centre with nearly 600 fintech start-ups, two-thirds of which are based at Cyberport, Chan thinks Hong Kong is well placed to export fintech solutions to the Greater Bay Area (GBA) and ASEAN.

He points out that start-ups are already trialling cross-boundary settlement and trade finance solutions for the GBA, and these could easily be applied to ASEAN or even Eurozone countries. He adds that many fintech solutions in Hong Kong already support multi currencies, making them easy to export.

Chan thinks there are also significant opportunities for the export of Regtech solutions. "As countries tighten their compliance requirements, it is getting to the point where, even if you have hundreds of people in your compliance team, you still have to turn to technology," he says. He points out that Hong Kong firms have a strong understanding of compliance standards in other countries and many already offer Regtech solutions for other jurisdictions. "Hong Kong is at the forefront as a Regtech hub," he says.

Maximising the benefits – and ROI – of proptech investments

Jordan Kostelac
Director, Proptech, JLL

Proptech has a key role to play in reducing the carbon footprint of buildings and improving the way the built environment operates.

Jordan Kostelac, Director, Proptech, at real estate services provider JLL, divides proptech's impact into three key areas, which he dubs the "three Ms", namely "mechanical", "material" and "menial".

He explains that buildings are heavily dependent on "mechanical" systems, many of which have become outdated and inefficient in terms of energy consumption. "Those systems rely on our understanding of physics and that has advanced since most of these buildings were built. We can use modern technology to help modernise and refit legacy power systems, to improve energy efficiency and reduce operating costs."

The "material" element covers the use of more environmentally sustainable materials in buildings, such as bamboo composites that have close to the tensile strength of steel. Moss walls can also be installed on the outside of buildings to filter air pollution and absorb carbon, also contributing points towards green building certifications. Kostelac points out that many industrial buildings in Hong Kong have entirely concrete facades on one side, which could be retrofitted with moss walls at a relatively low cost.

The third area in which proptech is having a major impact is on addressing the "menial" – unskilled, repetitive tasks. Kostelac says technology can be harnessed to provide people who carry out these tasks with tools that enable them to do their jobs better. An example in this area is using robots to clean floors, freeing up cleaning staff to focus on other areas of work.

Data-driven insights must be fuelled by accurate data and a clear purpose

Data plays a significant role in gaining insights for proptech innovation. Kostelac says JLL is integrating data collection into its existing processes: for example, it is using an augmented reality inspection and maintenance platform at a Hong Kong mall to log data while maintenance tasks are carried out.

Collecting data in this way not only reduces the risk of it being entered incorrectly, but the images gathered help the platform to develop "machine vision" to better recognise different maintenance functions. "We are using today's processes to train tomorrow's technology," he explains.

Kostelac suggests that when organisations collect data, they should be clear about what they are measuring, why they are measuring it and how the data will help them achieve their outcomes. He gives the example of a JLL portfolio company that produces an android-type box that plugs into the CCTV systems of malls and measures footfall against how long people spend looking in shop windows. "That is the kind of insight you can use to help your tenants and show that the landlord is interested in more than just monthly rental returns."

New ways to measure asset performance are needed to boost proptech adoption

As proptech has attracted the attention of investors in recent years, Kostelac says he seeing a lot more corporate venture capital going into the sector. In addition, some major developers in Hong Kong are setting up venture studios to develop their own proptech in-house, reflecting their changing attitudes towards tech adoption.

However, in order to convince more property managers that tech investments will generate shareholder returns, Kostelac says there should be revised thinking about how to measure how building assets perform.

Such measurements should incorporate factors like energy consumption, operations management and rental returns – both on an individual basis and across portfolios. He notes that other markets are already starting to look at these factors: for example, Singapore has set energy efficiency targets for buildings that must be met by 2030.

Another factor to consider is the rising demand among commercial and residential tenants for sustainable buildings. A recent JLL survey found that 70 percent of occupiers will be making leasing decisions in the future based on sustainability factors. "There are market forces to get ahead of. Beyond being the right thing morally, it is rapidly becoming a commercial imperative," Kostelac says.

Next steps for Hong Kong's smart city development

Maximum coordination is critical for the public and private sector to continue to build on their existing strengths and realise Hong Kong's smart city ambitions. This means coordination at multiple levels including government policy bureaux, delivery agencies as well as close collaboration with private sector and academia. As mentioned in Chapter 2 (p.16), further adapting the Government-Industry-University (GIU) cooperation model across smart-city related sectors could help to improve collaboration on smart city projects from concept to adoption.

Within the public sector it is important to coordinate the knowledge, expertise and efforts of a wide range of policy making groups. At a strategic level this includes connectivity between policymakers responsible for innovation & technology, land use and development, industry and economic development, social advancement, environmental management and public finances, to name a few. Harnessing the collective knowledge of these groups to craft a long term vision for Hong Kong's unique positioning and priorities as a smart city, would be a powerful and integrated statement of intent for Hong Kong – and result in a connected strategy with maximum stakeholder buy-in.

It is also important to ensure smart city developments are citizen-centric. This can be better achieved through facilitating two-way dialogue between government and city residents, as well as making sure people have the skills to access new technologies and solutions as they emerge.

As more technologies are adopted, the issue of cybersecurity becomes more pressing. There is a need to ensure that key infrastructure and government departments, as well as businesses and consumers, are adequately protected. Cybersecurity readiness requires a coordinated approach by government, backed by targeted legislation and minimum-security standards for IT devices and networks.

Meanwhile, data sharing across government departments, between the public and private sector, and across businesses is also important to maximise the impact and benefits of smart city applications. Government-backed platforms and incentives are likely to be needed to encourage private sector companies to pool their data to facilitate new smart city use-cases. The private sector also needs to promote success stories highlighting the benefits of data sharing to encourage more corporations to take part in such initiatives.

The rollout of 5G holds the potential to significantly accelerate Hong Kong's smart city development. But to take advantage of this enhanced connectivity, companies need to ensure they are investing in the right technologies; and that they have the right mindset and staff training in place to help them capitalise on the opportunities available.

The cities of the future must also be sustainable. Businesses have an important role to play in helping Hong Kong achieve its goal to be carbon-neutral by 2050, through helping to develop solutions that reduce carbon emissions.

Building on the enhanced spirit of cooperation during the COVID-19 pandemic, all parties should continue to work together to fast-track initiatives that can bring lasting benefits for residents.

Suggestions for the public sector and businesses

For the public sector:

Adapt the "Government-Industry-University" (GIU) model across smart city sectors. Enhanced GIU cooperation that supports projects from conceptualisation to adoption can enable enhanced innovation capabilities in Hong Kong's smart city sectors. GIU collaboration also increases the likelihood of project success, lifting Hong Kong's reputation as a leading smart and sustainable city and enabling it to export best practices to other markets.

Continue to promote citizen-centric development. More coordination is needed to promote "citizen-centric" smart development in public initiatives. Organisational culture across the public sector should be reviewed to ensure that a "citizen-centric" mindset is prevalent across departments. This will help to ensure that technology-driven public services are designed with citizens' needs in mind.

Develop cybersecurity standards for IT devices and networks. Review the government's current cybersecurity management strategy and in the development of any new regulations, work with industry and academia to develop commonly accepted cybersecurity standards for IT devices and networks that are relevant in the 5G-enabled era and in line with internationally-accepted norms.

Promote data sharing among public and private sector organisations. Along with the new Commercial Data Interchange announced in the Chief Executive's 2021 Policy Address, explore other platforms, incentives and regulation to encourage data sharing and the development of "data pools" within the public and private sectors, which would allow all parties and users to benefit while promoting healthy business competition.

For businesses:

Take advantage of incentives that support the development of 5G applications. Recent initiatives include the Hong Kong SAR government's Subsidy Scheme for Encouraging Early Deployment of 5G and the release of new 5G frequency bands in 2021. Business should explore new R&D and product deployment opportunities arising from these developments.

Advocate the benefits of data sharing and data pooling. Across industry as a whole and within individual sectors, businesses should be more proactive to actively communicate the commercial benefits and advantages of data sharing and data pooling, in order to encourage the development of more intelligent smart city applications. This includes developing more use cases that demonstrate the benefits and business potential of such projects.

Emphasise the "A,B,C,D,Es" of tech (AI, big data, cloud, data analytics, and edge computing) in workforce training programmes to ensure that talent is future-ready. With 5G-enabled applications becoming more widely adopted in coming years, understanding these tech elements will be even more critical to effectively develop and manage platforms. Concurrently, companies should focus on "soft skills" – such as agile-mindset, cooperation and teamwork, curiosity and willingness to step out of comfort zones, smart risk-taking, and effectively communicating and influencing stakeholders – which are critical to successful project implementation. As discussed in this report, Cyberport's Financial Practitioners FinTech Training Programme is a good example of how technology education can be incorporated into a sector-specific training programme. Similar approaches could be considered for other sectors in Hong Kong.

Seize opportunities associated with climate action. The HKSAR government's upcoming *Climate Action Plan 2050* is expected to create new targets for clean energy, electric vehicles, sustainable buildings, waste reduction and other areas. Businesses should seek opportunities to help the city work towards these collective goals. As mentioned in this report, given Hong Kong's strong proptech ecosystem, retrofitting existing buildings could be one area where Hong Kong can develop strong best practices for the rest of the Greater Bay Area and the ASEAN region.

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About KPMG China: Our Smart City proposition

By 2050, 75% of people living in Asia will live in an urban area, compared with approximately 50% in 2020. This scale of rapid urbanisation presents massive challenges in terms of providing current and future citizens with access to smart, secure, and sustainable infrastructure with regards to transport, healthcare, housing, power, and public services and amenities.

Internet of Things (IoT) will comprehensively transform the urban fabric of cities via the instrumentation, measurement and collection of data from potentially every physical 'thing' within a city. This will help cities and businesses make better, faster decisions, automate processes and better predict future events. It will also lead to improved city services such as better waste management, efficient transportation, as well as more closely monitored and improved food and water supplies, better air quality and improved amenities for citizens.

The collection and use of data is critical to the technology that enables the infrastructure of a smart city. However, both the data and the technology platforms embedded into infrastructure need to be protected. Securing data requires leading cyber security processes and systems.

KPMG's capabilities combine multiple disciplines, including Citizen Experience, IoT and Digital Transformation, Infrastructure and Cybersecurity & Risk to bring the skills and experience required to make smart cities a reality. Our Global Cities Center of Excellence is a central repository of proven best practice strategies, delivery models and tools; while our understanding of local trends, regulations and systems supports in the successful delivery of projects.

About KPMG's Global Cities Centre of Excellence

KPMG's Global Cities Centre of Excellence (CoE) brings together subject matter advisors and industry professionals from throughout the world to share leading practices, knowledge and experience.

Its mission is to advise and support the sustainable development of cities and the effective provision of city services.

Its clients include cities themselves, but also other levels of government that interact with, or give cities the mandate to operate their programs and services, and private sector firms who work/partner with cities.

The Cities CoE is staffed by experienced individuals who have in-depth knowledge of how cities operate, how they are governed and what programs and services they offer in different jurisdictions around the world, including tools and incentives for financial sustainability.

KPMG's understanding of municipalities enables us to provide advisory services that address the unique and specific needs of municipalities. We understand the scale of the issues that municipalities face.

KPMG's Cities CoE has access to knowledge capital from local and municipal governments located throughout the world. This knowledge database is used to supplement local municipal information and research that the Cities CoE has compiled in its support of hundreds of engagements worldwide.

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Strategic partners

Autotoll Smart Solutions

Autotoll has long been the pioneer of intelligent solutions for decades in Hong Kong.

To keep pace with the Hong Kong Government's "Smart City Blueprint", our services have branched out from Electronic Toll Collection (ETC) System since 1998 to multiple smart solutions after 2000s, such as Transportation and Surveillance Systems and Fleet Management Solution etc.

Today, Autotoll has transformed into a diversified business scope, covering the key aspects of Smart Mobility, Smart Logistics, Smart Living, Smart Environment and corporate & operations management etc.; as well as expanding the business from Hong Kong to the Greater Bay Area and other provinces in the Mainland. Moving forward, our dedicated professional team will leverage on its intelligent and innovative solutions to drive the city in a smarter way!

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CGI

Founded in 1976, CGI are among the largest IT and business consulting services firms in the world. We are insights-driven and outcome-based to help accelerate returns on our clients' IT and business investments. In all we do, our goal is to build trusted relationships through client proximity, providing industry and technology expertise to help clients meet the needs of their customers and citizens. With 400 offices across 40 countries, our Members live and work in the same communities as our clients, identifying with their challenges and opportunities to ensure that we consistently exceed expectations in delivering excellence in all that we do.

CGI are a major technology partner to not only many major industries and companies across the globe, but also to governments and local municipalities. We partner with city governments, leveraging our insights and technology to deliver outstanding outcomes for citizens in all services upon which communities rely. CGI partner within the communities we live and work to deliver beneficial solutions to local and national healthcare providers, to promoting clean energy solutions, to delivering citizen focused transportation solutions, to empowering digital capabilities in education, and beyond.

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CLP 中電

The CLP Group is one of the largest investor-owned power businesses in Asia Pacific with investments spanning across Hong Kong, Mainland China, Australia, India, Southeast Asia and Taiwan. Hong Kong-listed CLP Holdings Limited is the holding company for the CLP Group, which has a diversified portfolio of generating assets that uses a wide range of fuels including coal, gas, nuclear and renewable sources. In 2021, CLP celebrates the 120th anniversary of its founding in Hong Kong with a commitment to continue to move forward with the community based on a shared vision of a better tomorrow.

Through CLP Power Hong Kong Limited, the Group operates a vertically-integrated electricity supply business that provides a highly-reliable supply of electricity to 80% of Hong Kong's population. In Mainland China, the CLP Group is the largest external independent power producer with a focus on low-carbon energy. In Australia, the Group's wholly-owned subsidiary EnergyAustralia is a leading integrated energy company, providing gas and electricity to about 2.43 million households and businesses. Apraava Energy (formerly known as CLP India), in which the Group owns 60%, is one of India's biggest renewable energy producers with operations in power generation and transmission.

CLP Holdings is included in the Global Dow – a 150-stock index of the world's leading blue chip companies, the Dow Jones Sustainability Asia Pacific Index (DJSI Asia Pacific), the Dow Jones Sustainability Asia Pacific 40 Index (DJSI Asia Pacific 40), the Hang Seng Corporate Sustainability Index Series and the FTSE4Good Index series.

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數碼港 Cyberport

Cyberport is an innovative digital community with around 800 start-ups and technology companies on-site. It is managed by Hong Kong Cyberport Management Company Limited, which is wholly owned by the Hong Kong SAR Government. With a vision to be the hub for digital technology thereby creating a new economic driver for Hong Kong, Cyberport is committed to nurturing a vibrant tech ecosystem by cultivating talent; promoting entrepreneurship among youth; supporting start-ups on their growth journey; fostering industry development by promoting collaboration with local and international partners; and integrating new and traditional economies by accelerating digital adoption in the public and private sectors. Cyberport is focused on building three major application clusters, including FinTech, smart living and digital entertainment & esports, as well as three technology clusters, namely Artificial Intelligence (AI) & big data, blockchain and cybersecurity. With a committed team of professionals providing all-round value-added services to support our digital community and an array of state-of-the-art technology facilities, Cyberport seeks to become the flagship for Hong Kong's digital technology industry.

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DLA PIPER

DLA Piper is a global law firm with lawyers located in more than 40 countries throughout the Americas, Europe, the Middle East, Africa and Asia Pacific, positioning us to help clients with their legal needs around the world.

With a presence in Greater China since 1988, we are one of the largest and longest standing international law firms operating in the region, with over 200 lawyers across offices in Hong Kong, Beijing and Shanghai.

Turning a city into a smart city is a complex process that requires adequate investment to strengthen the local ecosystem. DLA Piper is uniquely placed to act on behalf of domestic and international investors thanks to our global footprint and extensive experience helping clients to develop smart projects and redefine strategic urban hubs. We are proud to be at the forefront of the industry, bringing together technology and sourcing lawyers as well as corporate, data protection, telecom, intellectual property, town planning, real estate, media, life sciences and commercial law experts.

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JLL

JLL is a leading professional services firm that specializes in real estate and investment management. JLL shapes the future of real estate for a better world by using the most advanced technology to create rewarding opportunities, amazing spaces and sustainable real estate solutions for our clients, our people and our communities. JLL is a Fortune 500 company with annual revenue of $16.6 billion in 2020, operations in over 80 countries and a global workforce of more than 92,000 as of June 30, 2021. With over 235 years of experience in real estate globally, our presence in Hong Kong was established in 1973, with over 7,000 staff in our offices and across client sites.

Sustainability

We have long-term, science-based sustainability targets firmly in our sights. We pioneer products and services that are good for business and effect real environmental change for a sustainable future.

Corporate social responsibility

We create and support diverse, inclusive and sustainable communities for the people who work, live and invest in them; today and in the future.

Technology

We embrace technology to meet the needs of today and opportunities of tomorrow. We are leveraging technology to increase the value of the world's buildings, enhancing the happiness and productivity of those who occupy them.

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Lenovo (HKSE: 992) (ADR: LNVGY) is a US$60 billion revenue Fortune Global 500 company serving customers in 180 markets around the world. Focused on a bold vision to deliver smarter technology for all, we are developing world-changing technologies that power (through devices and infrastructure) and empower (through solutions, services and software) millions of customers every day and together create a more inclusive, trustworthy and sustainable digital society for everyone, everywhere. To find out more visit https://www.lenovo.com, and read about the latest news via our StoryHub.

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Every day, MTR connects people and communities. As a recognised world-class operator of sustainable rail transport services, we are a leader in safety, reliability, customer service and efficiency.

MTR has extensive end-to-end railway expertise with more than 40 years of railway projects experience from design to planning and construction through to commissioning, maintenance and operations. Going beyond railway delivery and operation, MTR also creates and manages dynamic communities around its network through seamless integration of rail, commercial and property development.

With more than 40,000 dedicated staff, MTR carries over 13 million passenger journeys worldwide every weekday in Hong Kong, the United Kingdom, Sweden, Australia and the Mainland of China. MTR strives to grow and connect communities for a better future.

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SIEMENS

Siemens is a global technology powerhouse that has stood for engineering excellence, innovation, quality, reliability and internationality for more than 170 years. Active around the world, the company focuses on intelligent infrastructure for buildings and distributed energy systems and on automation and digitalization in the process and manufacturing industries.

In 1911, Siemens opened its first sales office in Hong Kong. Since then, the company has committed to being a trusted technology partner and providing innovative solutions in Hong Kong and Macao. Siemens has provided integrated solutions for infrastructure development projects, including power substations for CLP Power in Hong Kong and CEM in Macao; crane technology at Hong Kong's port and total building solutions for City of Dreams in Macao. In December 2017, Smart City Digital Hub was set up to unlock the potential of digitalization. Further information is available on the Internet at www.siemens.com.hk.

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signify

Signify (formerly Philips Lighting) is the world leader in conventional lighting, LED and connected lighting. With a presence in over 70 countries, we provide professional customers and consumers with energy efficient lighting products, systems and services. Our connected lighting offerings bring light and the data they collect to devices, places and people - redefining what light can do and how people use it, contributing to a more productive and smarter world.

Our position as the industry leader in connected lighting, makes Signify the lighting company for the Internet of Things (IoT). For more than 125 years we have pioneered breakthroughs in lighting and been the driving force for many innovations. We help customers navigate stores, use office space more efficiently, and develop actionable insights to improve energy usage through our IoT services. Through innovation, we are unlocking the extraordinary potential of light and we will continue to invest heavily in R&D to stay at the forefront of technological developments.

Signify is included in the DJSI World Index since our IPO for 4 consecutive years and Industry Leader in 2017, 2018 and 2019. In 2020, we are 100% carbon neutral in our operations and use 100% renewable electricity. With the United Nations´ Sustainable Development Goals as our strategic compass, we have launched our Brighter Lives, Better World 2025 sustainability programs to double our positive impact on the environment and society.

Our lighting-related products and services enable professionals and customers to enjoy a unique, superior quality of light; making people's lives safer and more comfortable; businesses and cities more energy efficient, productive and liveable; and the world more sustainable.

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SINO GROUP
信 和 集 團

Established in 1971, Sino Group comprises three listed companies – Sino Land Company Limited (HKSE: 083), Tsim Sha Tsui Properties Limited (HKSE: 0247), Sino Hotels (Holdings) Limited (HKSE: 1221) – and private companies held by the Ng Family.

As one of Hong Kong's leading property developers with core businesses in property development and investment, Sino Group has grown with the communities it serves. The Group's business interests comprise a diversified portfolio of residential, office, industrial, retail and hospitality properties across Hong Kong, mainland China, Singapore and Australia, and has developed over 250 projects, spanning more than 130 million square feet. Core business assets are further complemented by property management services, hotel investment and management, including The Fullerton Hotels & Resorts and other affiliate brands.

With over 11,000 committed staff members, the Group strives to fulfil its vision of Creating Better Lifescapes with a focus on three interconnected pillars – Green Living, Community Spirit and Innovative Design – shaping the cities we call home where people live, work and play. Sustainability is central to what we do as we seek to create value for stakeholders and make business a driver of sustainability for a better future.

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SCC
智慧城市聯盟
Smart City Consortium

Smart City Consortium (SCC) is formed by a group of professionals from different corporations and organisations to provide opinions and suggestions to the Government) for formulating related policies and standards in the development of Hong Kong as a world-class smart city. Our vision is to build Hong Kong as the world's leading Smart City to foster knowledge-based economy, enhance the quality of life and to create a vibrant ecosystem leveraging relevant Information and Communication Technologies and adopting effective resources management. We provide related opinions and suggestions based on our members' professional knowledge for the development of Smart City in Hong Kong. In past years, with the continuous support of our members, SCC has successfully organized and supported over 350 local and international events and over 10,000 people joined us there. To facilitate the international exchange of experience and to accelerate business opportunities, we have signed 43 memorandums of understanding with worldwide Smart City organizations, with many professional views and ideas exchanged with the overseas experts We encourage worldwide collaboration with different stakeholders to create the right ecosystem which fosters innovation and sustainable economic growth for Hong Kong.

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theDesk.

As a pioneer in Hong Kong's co-working space scene, theDesk has been redefining co-work through a collaborative community since the first space established in 2016. We are not only exploring how people work together in a physical space, but also designing virtual collaborative practices and solutions to enable business performance and personal growth in our community.

At theDesk, businesses grow with the collective intelligence of our community. Our spaces facilitate you to share insights and expertise, cross-pollinate ideas, develop new knowledge, and make unexpected collaborations. theDesk and our partner locations in Hong Kong allow us to provide the necessary means for our community members to concentrate on their goals and prepare for the future.

For more information, please visit www.thedesk.com.hk.

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For a list of KPMG China offices, please scan the QR code or visit our website: https://home.kpmg.com/cn/en/home/about/offices.html.

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